

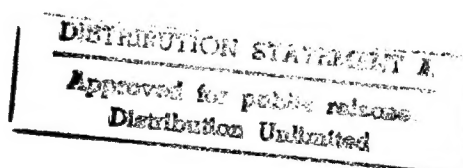
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28 January 1986

# China Report

SCIENCE AND TECHNOLOGY



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1

28 January 1986

## CHINA REPORT SCIENCE AND TECHNOLOGY

### CONTENTS

#### PEOPLE'S REPUBLIC OF CHINA

##### NATIONAL DEVELOPMENTS

Beijing Prepares for International Computer Congress (HONG KONG STANDARD, 21 Nov 85).....	1
SSTC Circular on Technology Market (Beijing Domestic Service, 4 Dec 85).....	3
Scientific Research Reform Includes Contracts (XINHUA, 16 Dec 85).....	4
Guo Shuyan on Research-Production Cooperatives (XINHUA, 14 Dec 85).....	6
Official Discusses Growth of Electronics Industry (XINHUA, 18 Nov 85).....	7
Large Spectra Information System Passes Test (XINHUA, 18 Dec 85).....	9
Mathematics Software Library Built in Beijing (XINHUA, 30 Nov 85).....	10
Computers Rapidly Becoming Popular Nationwide (XINHUA, 17 Dec 85).....	11
Microcomputers Popular in Meteorological Work (XINHUA, 16 Dec 85).....	13
China Succeeds in Computerizing Uygur Language (XINHUA, 18 Nov 85).....	14

Antarctic Scientists Return to Beijing (XINHUA, 7 Dec 85).....	15
Sichuan Trade Fair on Technological Achievements (Sichuan Provincial Service, 29 Oct 85).....	16
Tianjun Succeeding in Assimilating Imported Technology (Shi Delian; RENMIN RIBAO, 25 Oct 85).....	17
Briefs	
Medium-Sized Graphic Computer	19
Shanghai Mayor Attends Electronics Symposium	19
Integrated-Circuit Production Line	19
Telemetering Buoy System	19
Computer Circuits	19
Weather Forecast Computer	20
Yan Meets Hungarian Scientists	20
Automatic Scheduling	20
Scientists Delegation in Poland	20
Patent Applications	21
Artificial Joint Material Development	21
Integrated Circuits Mass Production	21
Pacific Survey	21
First Underwater Robot	21
APPLIED SCIENCES	
U.S. Strategic Defense Initiative Issues Probed (Sun Jian; HANGTIAN, No 5, 1985).....	23
Specter of War in Space Discussed (Bao Xianmin; HANGTIAN, No 5, 1985).....	30
Antimissile Interceptor Described (Ma Baoren; HANGTIAN, No 5, 1985).....	34
Aeronautics Industry Sees Boom in Seventh Five-Year Plan (ZHONGGUO XINWEN SHE, 20 Dec 85).....	37
New Aircraft Developed by Aviation Industry (XINHUA, 20 Dec 85).....	39
Status of Aircraft Engine Research at NPU Reviewed (GUOJI HANGKONG, No 10, Oct 85).....	40
Shanghai's Outdoor Aeroengine Test Facility Detailed (HANGKONG ZHIZAO GONGCHENG, No 7, 1 Jul 85).....	46
Applications of HIRFL Heavy Ion Accelerator Surveyed (Wu Guohua; WULI TONGBAO, No 4, 10 Aug 85).....	51

## LIFE SCIENCES

Snail Fever Eradicated in Shanghai, Says Mayor (Zhou Jierong; XINHUA, 10 Dec 85).....	59
Parasitic Disease Eliminated in Guangxi Region (XINHUA, 7 Nov 85).....	60
Nei Monggol Successfully Prevents Endemic Diseases (Nei Monggol Regional Service, 18 Dec 85).....	61
Briefs	
Sichuan Burns-Treatment Unit	62
White Blood Cell Treatment	62
Frozen Human Semen	62
Meningitis Cases Drop in Henan	62
Elimination of Snail Fever	63

## ENVIRONMENTAL QUALITY

Four Billion Yuan Per Year Spent on Cleaning Up Environment (Julina Chan; SOUTH CHINA MORNING POST, 16 Dec 85).....	64
Heilongjiang Provincial Environmental Protection Meeting Opens (Heilongjiang Provincial Service, 16 Dec 85).....	66
Anaerobic Biological Treatment of Wastewater Containing TNT, RDX (Xue Yuxiang; ZHONGGUO HUANJING KEXUE, Vol 5, No 5, 21 Oct 85).....	68
Briefs	
Tianjin Sewage Treatment Plant	78
Mayor Addresses Shanghai Forum	78
Governor Addresses Pollution Conference	78
Wuhan Company Fighting Pollution	79

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

Research Institute Initiates Technology Shareholding (Ruan Rongsen; RENMIN RIBAO, 11 Oct 85).....	80
Briefs	
Shanghai Mayor Attends Microcomputer Meeting	83
Science, Technology Association	83

## PUBLICATIONS

More on CHINA SCIENCE AND TECHNOLOGY NEWS (Hai Ning; GUANGMING RIBAO, 1 Nov 85).....	84
Science, Technology Magazine Begins Publication (XINHUA, 9 Oct 85).....	85

Briefs	
SCIENTIFIC NEWS Starts Publication	86

# ABSTRACTS

## ENVIRONMENTAL SCIENCE

ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] Vol 5, No 5, 21 Oct 85.....	87
--	----

## LASERS

ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] Vol 12, No 11, 20 Nov 85.....	92
---	----

GUANGXUE XUEBAO [ACTA OPTICA SINICA] Vol 5, No 10, Oct 85.....	96
--	----

## ORGANIC CHEMISTRY

YOUJI HUAXUE [ORGANIC CHEMISTRY] No 4, Aug 85.....	102
--	-----

# TAIWAN

Briefs	
New Facsimile System	103
32-Bit Development System	103

NATIONAL DEVELOPMENTS

BEIJING PREPARES FOR INTERNATIONAL COMPUTER CONGRESS

HK210409 Hong Kong HONG KONG STANDARD (BUSINESS STANDARD Supplement) in English 21 Nov 85 p 3

[Text] The steering committee for the International Congress for Computers and Communications in Science and Technology (ICCC '86) held its first meeting recently in Beijing to develop a program for this important event.

ICCC '86 will take place in September 1986 concurrent with a major international exhibition, INTERCOMM '86 (incorporating China COMM '86), to be staged in Beijing.

The committee, together with the advisory board of ICCC '86 and INTERCOMM '86, is headed by Professor Hu Qiheng, president, China Computer Society (CCS) which is sponsoring the combined event. The prestigious committee and board bring together China's leading experts on computer and communication technology.

The program sub-committee is chaired by Professor Chang Xiao-xiang, vice president, CCS and Professor Zeng Maochao, director of the Institute of Computer Technology, China Academy of Science. Other prominent members include Professor Yang Fuqing, director of the Computer Department, Beijing University; Professor Ci Yungui, Chinese Academy of National Defence and vice president, CCS; Professor Zhu Xinpu, Ministry of Electronic Industries and vice director, North China Computer Technology Institute; Hong Minguang, chief manager, China Softward Technology Company and others.

The overall organizing committee is chaired by Xu Kongshi, director of the Institute of Software, China Academy of Science and Wu Ganmei, director of the China International Conference Centre for Science and Technology, China Association for Science and Technology (CAST), the event's host.

The committee discussed many topics concerning the event and developed a program, both conference and exhibition, to be of greatest benefit to China.

For the conference, a call for papers will be issued for presentations on seven topics:

1) Microcomputer and their applications in process control, information processing, office automation and data base management; 2) CAD/CAM/CAE; 3) software engineering; 4) artificial intelligence systems; 5) communications in computer network; 6) telecommunication network architecture and network capabilities and 7) network technologies.

Concerning the exhibition, plans were drawn up to provide for targeted visitor promotion and invitations, for foreign currency allocations and for technical presentations by existing companies.

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CS0: 4010/1022



28 January 1986

## NATIONAL DEVELOPMENTS

## SSTC CIRCULAR ON TECHNOLOGY MARKET

OW051053 Beijing Domestic Service in Mandarin 1200 GMT 4 Dec 85

[Text] The State Scientific and Technological Commission recently issued a circular calling on all localities and departments to effectively step up the management of the technology market.

The circular says: The flourishing technology market in the country this year has given a strong impetus to the transfer of technologies and their popularization and application in production. However, there are also problems that merit our attention. For examples, a few units and individuals have sold incomplete and unreliable technologies; a small handful of units or individuals have plagiarized other's transferred technologies; and so forth.

Calling on all localities and departments to set up or improve necessary management and operational systems, the circular points out: The scope and form of the technology market may be varied, but it is necessary to stress efficiency and refrain from demanding uniformity. Transferred technologies should be complete technologies or technologies achieved at different research stages. It is forbidden to exaggerate, fake, or plagiarize other's technologies. In trading a technology, it is necessary to explain the technology accurately with a serious, earnest, and responsible attitude, and sign and abide by technology contracts according to relevant regulations. Institutions engaged in technological development and exchange must have a clear service direction and content of management. They must be equipped with scientific and technical forces, funds, working locations, and rules and systems commensurate with the contents of management. Scientific and technical personnel, provided that they complete their own work and do not encroach on their own units' technological rights and economic interests, are allowed to earn a moderate income by engaging in technological work and consultancy in their spare time. Scientific and technical personnel engaged in managerial work in technology markets or in other technology management activities should be treated the same in salaries and technical job titles as scientific and technological personnel engaged in research and development. Outstanding personnel should be commended.

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CSO: 4008/2039

NATIONAL DEVELOPMENTS

SCIENTIFIC RESEARCH REFORM INCLUDES CONTRACTS

OW160820 Beijing XINHUA in English 0756 GMT 16 Dec 85

[XINHUA headline--"Reform Injects Life Into Scientific Research"]

[Text] Beijing, 16 Dec (By XINHUA correspondent Lai Yunchuan)--Go Out and Find Buyers of Research Results Instead of Waiting for the State To Assign Tasks--This Is One of the Current Policies To Boost China's Scientific Research. [dateline as received]

Research units now sign contracts for research projects or sales of research results, now regarded as commodities, according to officials here.

In the past, such units cared little about whether research results were used or not, for spreading such results was not their business.

One example is the Beijing Institute of Agricultural Machinery. From 1985 to 1988, its annual research allocations from the government will be cut at a rate of 30 percent every year.

"We are now compelled to get contracts so that in 1988, we will be independent of the government for money," said institute director Yu Bo.

The institute earned 240,000 yuan last year by selling research results, he said, and its profits for the first 9 months totaled 440,000 yuan. The annual research appropriations from the government used to be 540,000 yuan.

The institute undertakes projects in animal husbandry, fisheries, vegetable growing, and horticulture as well, Yu said. "In the past," Yu added, "we did farm machinery research only and didn't care much even if our research results were shelved."

There are 80 technical research institutes operating under the municipal authorities of Beijing. The initiative-based contract system had been adopted by all except for three which were set up in the past couple of years.

As a matter of fact, said officials at the city's Science and Technology Commission, eight institutes specializing in technology development and applied sciences are already financially independent.

The system was first tried out in 1981 in four institutes. The number increased to 50 in 1984.

But the city government continues to supply its research units of medicine and public services with operation and research funds. "These should not be profit-oriented," said one official at the Science and Technology Commission.

Going hand in hand with the contract system is the practice of "more pay for more work" for individual researchers.

The research institutes retain the bulk of the earnings from sales of research results, and use the rest to improve fringe benefits and working conditions and award outstanding workers.

The incentive pay for the research staff varies from institute to institute, depending on how profitable each is.

But one engineer at the Agricultural Machinery Institute told XINHUA that she got 1,200 yuan in the first half of this year, about as much as her salary for the year.

In addition, Zhang Shufang, 47, had her monthly wages raised one grade. She has been working on five research projects simultaneously since January.

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CSO: 4010/2004

NATIONAL DEVELOPMENTS

GUO SHUYAN ON RESEARCH-PRODUCTION COOPERATIVES

OW140856 Beijing XINHUA in English 0733 GMT 14 Dec 85

[Text] Dalian, December 14 (XINHUA)--Nearly 10,000 research-production cooperatives--joint ventures between research institutes, colleges, and enterprises--have been set up across China since 1980, a national conference here was told.

Such cooperatives are also carrying out cooperation with foreign institutes in research and production, State Council official Guo Shuyan said at the conference which opened in this port city Friday.

They have switched from cooperation in developing a single item of technology to developing a full range of technology and contracting engineering projects, Guo said.

These cooperatives are believed to meet the needs of the current reform of the science and technology management system, and the entire economic system.

Guo listed other development trends of the cooperatives as follows:

- Undertaking technological and economic development projects for an entire industry or a region, instead of tackling key technical problems;
- Carrying out cooperation involving diverse branches of science, and across the departmental and regional boundaries;
- Moving from technology transfer to joint investment and operations; and
- Jointly developing new industries instead of only technology.

Guo said that research-production cooperatives are helping major enterprises develop new technology, and speed up the technological progress of smaller ones and rural factories.

The cooperatives have enabled research institutes and colleges to cater to the country's economic needs, and military technology to be transferred to civilian use. They also help to improve scientists' and workers' skills, and to train managerial personnel, he added.

NATIONAL DEVELOPMENTS

OFFICIAL DISCUSSES GROWTH OF ELECTRONICS INDUSTRY

OW181900 Beijing XINHUA in English 1648 GMT 18 Nov 85

[Text]: Beijing, 18 Nov (XINHUA)--The output value of China's electronics industry is expected to reach 28 billion yuan (about 9 billion U.S. dollars) by the end of this year, up 180 percent over 1980, the starting year of the Sixth 5-Year Plan.

An annual growth rate of 22.8 percent will be recorded for the electronics sector, well above the average increase by industry nationwide during the 5-year period. This was announced by Liu Jianfeng, vice minister of the electronics industry, at a news briefing here today.

"China's electronics industry plans to increase its production by 16.5 percent annually in the next 5 years, with the output value set at 60 billion yuan by 1990," the vice minister said.

Based on microtechnology, the development of integrated circuits, telecommunications, computers, and software will be given top priority in the next 5 years to suit the country's economic construction and domestic demand.

China's policy of opening to the outside world has given a great impetus to the electronics industry. For example, the city of Shenzhen has established over 170 electronics enterprises, whereas it only had 1 radio factory a few years ago. The output value of the electronics industry came to 700 million yuan last year, accounting for more than 50 percent of the city's total industrial output value.

Over the past few years, Liu said, China's electronics industry has imported 1,135 items of advanced technology and equipment, involving 1.37 billion U.S. dollars. With the imported technology and equipment, about one-third of the key electronics enterprises have been completely or partially transformed.

The vice minister said that scientific research had helped the country to master technology for producing a number of new electronic goods. Between 1981 and 1984, more than 1,900 scientific achievements made by the ministry were given awards by the state, including telemetering and controlling systems for satellites and rockets and satellite ground stations. The technical level of some electronic products is up to the advanced international standards.

The quality of China's electronic goods has been improved markedly, Liu said. The trouble-free working-time of black-and-white television sets went up to over 5,000 hours from 200 hours, while that of color TV sets was more than 15,000 hours.

New progress has also been made in the production and application of electronic computers. At present, there are 5,500 big, medium, and small computers and 100,000 micro ones in China, many of which are in use in industry, transportation, energy, commerce, banking, national defense, scientific research, education, and agriculture.

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CSO: 4010/1018

## NATIONAL DEVELOPMENTS

### LARGE SPECTRA INFORMATION SYSTEM PASSES TEST

OW181344 Beijing XINHUA in English 1255 GMT 18 Dec 85

[Text] Beijing, 18 Dec (XINHUA)--A mass spectra information system, the largest in China, passed an appraisal test at a meeting organized by the Chinese Academy of Sciences here today.

The system is used for analysis of the composition and structure of organic compounds.

The system, developed by scientists at the Academy's Institute of Chemistry over 3 years, now stores mass spectrograms of more than 38,700 compounds, widely used in the fields of scientific research, product quality control, environmental protection, medicinal analysis, and the petrochemicals industry.

Thirty experts and researchers from the research institutes under the Chinese Academy of Sciences, Nankai, and Qinghua Universities, and other units attended the meeting. They viewed that the system is easy to operate and information retrieval is swift. Its performance is up to the standard of similar systems abroad, they said.

The system is part of the chemical data bank being built by the Chinese Academy of Sciences. The bank includes other systems of infrared, chemical engineering, nuclear magnetic resonance, chromatographic, and chemical documentation data.

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CSO: 4010/1018

NATIONAL DEVELOPMENTS

MATHEMATICS SOFTWARE LIBRARY BUILT IN BEIJING

OW301342 Beijing XINHUA in English 1142 GMT 30 Nov 85

[Text] Beijing, 30 Nov (XINHUA)--China's first mathematics software library serving scientific and engineering research has been built in Beijing and passed an appraisal meeting here today. Mathematics software is one of the basic types of software in the application of computers to scientific research, engineering, economic management, biology and medical science.

Scientists at the library have so far developed 18 software products including general-purpose mathematics sections, software packages for microcomputers, economic mathematics and education software packages.

At present, the library's services are used on 54 types of computers in over 200 institutions.

The library, equipped with mathematics software from both China and abroad running to nearly one million lines, was one of the country's major scientific research projects during the sixth five-year development plan period (1981-1985). It was completed by 50 scientists and technicians after three years of effort.

Attending the appraisal meeting were more than 60 computer experts from ministries and commissions under the state council, the Chinese Academy of Sciences, and universities and colleges.

They said that the software products are easy to use and have a good adaptability. They are now used by the industrial, agricultural, education and economic departments as well as research institutions.

The project was undertaken by the computer center under the Chinese academy of sciences, with the cooperation of Beijing and Qinghua Universities, a computer center under the State Planning Commission and other five units.

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NATIONAL DEVELOPMENTS

COMPUTERS RAPIDLY BECOMING POPULAR NATIONWIDE

OW171250 Beijing XINHUA in English 1140 GMT 17 Dec 85

[Text] Beijing, 17 Dec (XINHUA)--The worldwide computer wave has spread to China at an unexpected speed, according to a recent issue of the weekly BEIJING REVIEW. China now has tens of thousands of microcomputers in operation, 20,000 of which have been produced domestically.

It has more than 90,000 computer workers, 8 computer research establishments, 111 computer factories, and 40 computer service units.

"A year ago we were worried about our ability to make computers popular in China," said an official at the Electronics Industry Ministry. "Now," he said, "with the increase in variety and the overall boost in quality, the demand for, and use of, computers in China has gone far beyond our expectations."

The country now produces an assortment of microcomputers, from simple four-digit models to multifunctional 32-digit ones, and from personal computers for household use to computer program-controlled systems for commercial use.

Some China-made microcomputers, such as the Great Wall 0520 and the Zijin 2, are being mass produced at about 10,000 annually.

According to one estimate, in 2 years China will be able to produce 100,000 microcomputers a year.

The country has also put considerable emphasis on research into Chinese character information processing systems, with several dozens of the systems having been developed in the country.

Liu Jianfeng, vice minister of the Ministry of Electronics Industry, noted that China's modernization has placed an ever-increasing demand on computers and computer equipment, and it has been impossible to meet that demand with imports.

The vice minister stressed that it is imperative for China to strengthen its own computer technology research and development. At the same time, he added, appropriate policies should be introduced to facilitate the growth of the country's own computer industry.

China has also been commercializing software. It is a major breakthrough for the country's computer industry, for in the past its software capabilities were severely limited. Now, however, even a program designed by an individual can be brought to a software center for adaptation as long as it has passed the necessary testing.

A national software company has been established to facilitate information exchanges and streamline the production of the various software departments.

A nationwide computer service network also has taken shape in the country. Since it was established in 1980, the China Computer Technology Service Company has set up 33 branches throughout the country.

Through the efforts of the Computer Service Co., seven textile mills in Shanghai, Changzhou, and Shenyang have installed computer-controlled looms.

In its development of computers, China has paid attention to spreading computer knowledge among children. According to incomplete statistics, computers have been introduced in secondary and primary school classrooms in 10 provinces and municipalities.

In 1984, 23 factories turned out 150,000 "baby computers" for use by children. The planned output of baby computers for this year was 200,000. The price for seven models has been reduced from more than 1,000 yuan to around 300 yuan.

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CSO: 4010/1018

28 January 1986

## NATIONAL DEVELOPMENTS

### MICROCOMPUTERS POPULAR IN METEOROLOGICAL WORK

OW161350 Beijing XINHUA in English 1318 GMT 16 Dec 85

[Text] Beijing, 16 Dec (XINHUA)--Microcomputers are becoming common in China's meteorological work, according to the State Meteorological Bureau today.

Over 4,000 such computers are in use for weather forecasting, ground and high-altitude observation, control of meteorological radar, relay of data, image processing, and processing of satellite photos. They are also used in management.

Local microcomputer systems which facilitate forecasts of immediate weather changes have [words indistinct] developed.

"We no longer rely on human experience to make weather forecasts," a bureau spokesman told XINHUA. Microcomputers are being used in increasing numbers even in grassroots meteorological stations, which make forecasts by combining local data and data from the central station.

(?Microcomputer) systems have been developed using display and printing mesh point data, he said.

In China, he added, microcomputers were widely used in meteorological work only 3 years ago and now every 70 (?meteorologists) share one.

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CSO: 4010/1019

## NATIONAL DEVELOPMENTS

### CHINA SUCCEEDS IN COMPUTERIZING UYGUR LANGUAGE

OW181333 Beijing XINHUA in English 1306 GMT 18 Nov 85

[Text] Urumqi, 18 Nov (XINHUA)--China has succeeded in computerizing the Uygur language, the language of a minority nationality in the far west's Xinjiang Uygur Autonomous Region.

According to experts here today, a microcomputer system for processing the language has been developed by Xinjiang Institute of Industrial Engineering with the help of South China Teacher's University. The experts noted that the system is capable of processing texts in the Uygur language, as well as in Chinese and English.

The system can be applied to teaching, the study of the Uygur language and office work, they added.

The Uygur language was difficult to computerize as it is written from right to left and its 32 basic letters have 127 variations altogether. The computer system simplifies the variations to 53 and then processes the language in two ways:

--feeding the language into computers in its own right-left order, and;

--making the language automatically change into the left-right order when English words are inserted.

China has 55 ethnic minorities, with a combined population of about 60 million. The Uygur has a population of 6 million.

Uygur is the first among the minority languages to be successfully computerized. A program is now underway for processing the rest of the minority languages with microcomputers.

Research on processing minority languages began in 1980, alongside research into computerizing Chinese characters. More than 400 systems have now been developed throughout the world for Chinese characters.

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CSO: 4010/1019

NATIONAL DEVELOPMENTS

ANTARCTIC SCIENTISTS RETURN TO BEIJING

OW072214 Beijing XINHUA in English 1628 GMT 7 Dec 85

[Text] Beijing, 7 Dec (XINHUA)--The first group of eight scientists at the Chinese "Great Wall" Research Station in Antarctica returned here this evening after 8 months of wintering surveys. The "Great Wall" Station, located on George Island, was built in February this year.

During their stay at the station, the scientists conducted research in geophysics, geomagnetism, biology, meteorology, high-altitude atmospheric physics, mapping, and telecommunications. They drew more than 500 meteorological maps and obtained other data and specimens. The data will provide information for a better understanding of the continent and further scientific surveys there.

The "Great Wall" Station has been approved as an international meteorological observation station, according to the scientists.

Welcoming them at the airport were Wu Heng, chairman of the Chinese National Committee for Antarctic Research, and Yan Hongmo, director of the State Bureau of Oceanography.

At present, China's second expedition team, composed of 41 people, including two Hong Kong compatriots and two scientists from Chile, is conducting summer surveys at the "Great Wall" Station.

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CSO: 4010/1019

NATIONAL DEVELOPMENTS

SICHUAN TRADE FAIR ON TECHNOLOGICAL ACHIEVEMENTS

HK020343 Chengdu Sichuan Provincial Service in Mandarin 0030 GMT 29 Oct 85

[Text] The province's first autumn trade fair on technological achievements opened yesterday at Renmin Nan Lu exhibition hall, Chengdu. The opening ceremony was attended by Yang Rudai, secretary of the provincial CPC committee; Song Dafan, standing committee member of the provincial CPC committee; Gu Jinchi, vice governor of the provincial people's government; as well as leading comrades of the provincial departments concerned.

At the opening ceremony, Comrade Gu Jinchi delivered a speech. He said: The purpose of this trade fair is to fully implement the decision of the CPC Central Committee on reforming the scientific and technological structure, to promote the development of scientific and technological achievements as commodities, and to promote the shift of scientific and technological achievements to developing production.

Comrade Yang Rudai cut the ribbon. Later, the leading comrades of the provincial CPC committee and government enthusiastically accompanied the guests visiting the fair.

This 12-day trade fair on scientific and technological achievements exhibits more than 7,000 trading items, including scientific and technological achievements and economic and technological cooperation. The trading forms include technological transfer, provision of support services, exchange of qualified personnel, technological contracts, buying shares, and joint ventures. Various cities, prefectures and autonomous prefectures in the province have sent trade delegations to this fair.

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CSO: 4008/2039

NATIONAL DEVELOPMENTS

TIANJIN SUCCEEDING IN ASSIMILATING IMPORTED TECHNOLOGY

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 25 Oct 85 p 2

[Article by Shi Delian [4258 1795 6647]: "Import Technology, Export Products--Tianjin's Achievements in Importing and Assimilating Technology"]

[Text] Last year, Tianjin put into operation 102 imported technical projects and produced 127 varieties of new products of advanced standards with an annual output value of 380 million yuan. The taxes paid and profits delivered amounted to 108 million yuan. Of these new products, 66 varieties are being sold in distant foreign countries and the foreign exchange earned and saved exceeded \$4 million, equivalent to more than three-quarters of the foreign exchange investment in these imports.

Giving Prominence to Key Points in Importing

In March 1983, Tianjin received approval from the State Council for importing technology for the transformation of small- and medium-size enterprises. After the experiments of expansion of the enterprises' decisionmaking power, Tianjin concentrated its attention on 26 key trades which produced competitive goods instead of attempting an "all-round transformation" of all trades, when the associated projects were imported. Thus some products were updated fairly rapidly and the backward technology of factories in some trades was improved. The equipment of the decorative printing trade in Tianjin was formerly quite obsolete; in the past several years, these factories imported some technical equipment from foreign countries, manufactured some new equipment by learning from advanced technology, and eliminated more than 800 sets of outdated equipment. Now, 60 percent of the equipment in this trade is of the advanced type, and the backwardness of the entire trade has ended.

One of the characteristics in the imports of Tianjin is the priority of technology over equipment. Tianjin believed in the need to import some equipment, but in view of the restrictions in developing production and technology, it has raised the proportion of technology in its importation plan. As a result, the all-purpose petroleum machinery, motor vehicle, metallurgical product and radio industries are now in a better position to develop their products.

## Distinctive Goals of Products

In importing technology and transforming its small- and medium-size enterprises, Tianjin has its eyes on the international market and is striving to increase its exports for foreign exchange earning. Even though some imported products have to be sold on the domestic market, it makes every effort to substitute domestic for imported products in order to save the state's foreign exchange. To accomplish this, Tianjin had to check every imported item very carefully to be sure that it can produce fine-quality products. It would never permit the use of advanced technology to produce low-grade goods.

The Tianjin Printing and Dyeing Plant spent \$6.7 million in importing 15 sets of chemical fiber printing and dyeing equipment and made it possible for its polyester/cotton and bleached polyester/cotton fabrics with printed designs to enter the international market. Now, its foreign exchange earnings double its foreign exchange investment every year.

## Methodical Assimilation of Technology

Tianjin has been able to improve its economic results fairly shortly after importing technology mainly because it has made great efforts in its digestive and creative work. Its methods are mainly as follows:

Item: Joint digestion and absorption with the help of social resources. In the past, the technology, design, techniques, parts, elements and materials of some large imported projects were distributed among various trades with no unified guideline. As a result, there were problems with the lack of a common goal and synchronized progress, and competitive power could not be increased. In view of this, Tianjin is now dividing up the project to form a "chain" extending across trade boundaries and having the plant using the main machine as the "leader." The work of digestion, absorption and development is now all coordinated throughout the "chain."

Item: Striving for creation in the course of digestion and absorption. Many units in Tianjin are not contented with merely the operation and use of imported technology, and are making every effort to combine digestion with creation so that the imported technology could be used more intensively and extensively, and with better results. No 6 Radio Elements Plant, for example, imported the technology of producing delay lines. According to the original design, the product could fit only one type of color television. After digestion and improvement by the plant, the lines are now suitable for all the color TV sets in the country, and one of these lines can serve the purpose of several other lines.

Item: Proceeding from the overall situation instead of "Tianjin alone." The purpose of digesting and absorbing imported technology is to increase the productive forces in China. Though located in Tianjin, the Tianjin enterprises are bearing in mind the whole country instead of trying to make Tianjin conspicuous in every way. If any project has already been imported by another province or city, Tianjin never duplicates it. In other words, Tianjin would do anything to refrain from engaging in "rivalry" with other places.



NATIONAL DEVELOPMENT

BRIEFS

MEDIUM-SIZED GRAPHIC COMPUTER--Beijing, 26 Oct (XINHUA)--A medium-sized graphic computer, Model TJ-82, passed the test at Qinghua University today. According to the experts conducting the test, this computer is up to modern international standards. The test was sponsored by the Ministry of Electronics Industry. Representatives from the State Scientific and Technological Commission and the State Education Commission were present. Research fellows and students from Qinghua University joined in developing this computer. [Summary] [Beijing XINHUA Domestic Service in Chinese 1242 GMT 26 Oct 85 OW] /9365

SHANGHAI MAYOR ATTENDS ELECTRONICS SYMPOSIUM--A symposium on China's electronics industry in the year 2000 opened in Shanghai on 7 November. Shanghai Municipal Mayor Jiang Zemin attended and spoke at the symposium. Minister of Electronics Industry Li Tieying briefed the symposium participants on the current situation and future tasks of the electronics industry. The symposium participants will discuss such topics as micro-electronics technology of the 1990's and communications, radio and TV, computers, diaphragms, optical fibers, and electronic defense equipment in the year 2000. [Text] [Shanghai City in Mandarin 2300 GMT 7 Nov 85] /9365

INTEGRATED-CIRCUIT PRODUCTION LINE--A production line for manufacturing integrated circuits passed appraisal by the Chinese Academy of Sciences on 11 November. The production line shows that China has been able to mass produce integrated circuits. [Summary] [Beijing Domestic Service in Mandarin 1200 GMT 11 Nov 85 OW] /9365

TELEMETERING BUOY SYSTEM--Shanghai, 28 Nov (XINHUA)--A maritime telemetering buoy system, codenamed HEB-1A, was successfully tested here today. The system, developed by the Shandong Provincial Maritime Instruments and Meters Institute, will make China's maritime hydrometeorological forecast more accurate and contribute to the development of its maritime exploitation, transportation, salvage, and fishing industry. [Summary] [Beijing XINHUA Domestic Service in Chinese 1500 GMT 28 Nov 85 OW] /9365

COMPUTER CIRCUITS--All microcomputer circuits for use on the (3JF-060) series have been successfully developed in Shenyang. [Summary] [Beijing Domestic Service in Mandarin 1200 GMT 5 Dec 85 OW] /9365

WEATHER FORECAST COMPUTER--Beijing, 14 Dec (XINHUA)--The Meteorological Academy and the Weather Center, both under the Air Force, have developed a computerized weather forecaster, which is a specially programmed microcomputer, capable of forecasting weather for the 24 hours following the input of current weather data. Anyone with meteorological knowledge can use this computerized weather forecaster, which has recently passed state tests. [Summary] [Beijing XINHUA Domestic Service in Chinese 0159 GMT 14 Dec 85 OW] /9365

YAN MEETS HUNGARIAN SCIENTISTS--Beijing, 29 Nov (XINHUA)--Yan Jici, vice-chairman of the National People's Congress Standing Committee, met a delegation from the Hungarian Academy of Sciences, led by its vice-president, Straub Bruno, here today. During the meeting, Yan said he was pleased with cooperation between Chinese and Hungarian scientists since the signing of a bilateral scientific exchange agreement in September, 1984. He believed that scientists from the two countries would now expand this cooperation. The delegation arrived here 10 days ago at the invitation of the Chinese Academy of Sciences. An agreement on cooperation between the two scientific academies during 1986 and 1987 was signed here yesterday. [Text] [Beijing XINHUA in English 1443 GMT 29 Nov 85 OW] /9738

AUTOMATIC SCHEDULING--Beijing, 30 Nov (XINHUA)--The first stage of automatic scheduling of an electric network in southwest China went into operation this month, says today's PEOPLE'S DAILY. This is the biggest automatic scheduling system developed by China itself and the first Chinese character automation system. The first stage, a safety monitoring system, includes data collecting, safety monitoring, alarming and printing facilities. These enable scheduling workers to monitor production of 10 power plants and 14 transformer stations. The paper does not specify the generating capacity of these plants. [Text] [Beijing XINHUA in English 0802 GMT 30 Nov 85 OW] /9738

SCIENTISTS DELEGATION IN POLAND--Warsaw, 24 Nov (XINHUA)--A delegation of the China Association for Science and Technology and the China Science Writers Association visited Poland from 14 to 24 November. This was the first contact of Chinese scientists with their Polish or any East European colleagues in the past 25 years. The delegation was led by Cao Lingzhong, member of the secretariat of the China Association for Science and Technology. During its stay here, the delegation held talks with Janusz Gorski, chairman, and Marek Zukowski, secretary general of the National Council of the Polish Society for the Propagation of Knowledge, and met Kazimierz Wawrz, secretary general of the Polish Technology Association. The delegation also attended the Ninth Congress of the Polish Society for the Propagation of Knowledge on 21 and 22 November, and visited other cities. [Text] [Beijing XINHUA in English 0245 GMT 25 Nov 85 OW] /9738

PATENT APPLICATIONS--Beijing, 20 Sep (XINHUA)--More than 10,000 applications have been recieved by the China Patent Office since the country's patent law took effect 1 April this year, the office announced here today. It said a breakdown of the figures shows that on 12 September, when the number reached exactly 10,000, there were 1,176 applications for invention patents, 3,400 applications for utility models, and 424 applications for designs. Two-thirds of the applications were filed by Chinese organizations and individuals, and the other 3,311 applications were filed by foreigners. It said the large number of applications filed in such a short period of time is a rare occurrence in any country and had exceeded the expectations of both Chinese and foreign experts. [Text] [Beijing XINHUA in English 0810 GMT 20 Sep OW] /9365

ARTIFICIAL JOINT MATERIAL DEVELOPMENT--Changchun, 29 Aug (XINHUA)--A carbon material has been developed in China to replace metals, plastics, and ceramics in making artificial joints. The material and the relevant technique--carbon cup hiparthroplasty--were approved for clinical use officially at a meeting in Jilin City, Jilin Province, Tuesday. Between 1977 and May this year, the material has been successfully used in 15 cases. The material was developed jointly by the Jilin City Central Hospital and the Jilin Carbon Factory. China began studying artificial joints in the 1970's, and was a pioneer in applying ceramics in the early 1980's. [Excerpts] [Beijing XINHUA in English 1452 GMT 29 Aug 85 OW] /9365

INTEGRATED CIRCUITS MASS PRODUCTION--Beijing, 24 Nov (XINHUA)--A factory under the Academy of Sciences of China has successfully carried out experiments in the mass production of integrated circuits, today's SCIENCE NEWS reports. The factory has established a full range of technological processes and operational procedures for producing integrated circuits. The standard rate of finished products is reportedly high and stable. The experiment is one of the key research projects assigned by the state for the Sixth 5-Year Plan period from 1981 and 1985. According to electronics experts, the success has provided a pattern applicable in developing China's integrated circuits industry and in retooling the existing production lines of semiconductor devices and developing new technology. It will also be useful in ensuring the normal operation and retooling and upgrading of the imported production lines. [Text] [Beijing XINHUA in English 0842 GMT 24 Nov 85 OW] /9365

PACIFIC SURVEY--Guangzhou, 10 Dec (XINHUA)--A Chinese scientific survey ship, the "Shiyan 3," left here today for the western Pacific for winter research. The ship, belonging to the Chinese Academy of Sciences, will cover a total voyage of about 13,000 kilometers. The survey group on board will set up 71 observation stations. [Text] [Beijing XINHUA in English 1903 GMT 10 Dec 85 OW] /9365

FIRST UNDERWATER ROBOT--Beijing, 14 Dec (XINHUA)--China's first underwater robot recently completed trials at the northern port city of Dalian, according to the Chinese Academy of Sciences here today. The robot, HR-01, is equipped with observation and positioning systems, and a mechanical hand, as well as a control system for direction, depth and navigation. Weighing 2.5 tons, it can

dive to a depth of 200 meters. It was designed and manufactured by the Shenyang Automation Institute under the Chinese Academy of Sciences, in cooperation with Shanghai's Jiaotong University and other units. The underwater robot can probe the seabed and can be used in offshore oil exploration, marine rescue, salvage, marine farming, and dam inspection. [Text] [Beijing XINHUA in English 1255 GMT 14 Dec 85 OW] /9365

CSO: 4010/1019

APPLIED SCIENCES

U.S. STRATEGIC DEFENSE INITIATIVE ISSUES PROBED

Beijing HANGTIAN [SPACEFLIGHT] in Chinese No 5, 1985 pp 6-8

[Article by Sun Jian [1327 0313]]

[Text] Question: What is the United States' "Star Wars" plan?

Answer: The "Star Wars" plan refers to the Strategic Defense Initiative (SDI) which was initiated by the U.S. Department of Defense in 1984. Its objective is to develop an advanced antimissile system to protect the United States from nuclear attack. In the first phase of this plan, which will extend from fiscal year 1984 to fiscal year 1989, \$24.7 billion will be allocated to study the technical feasibility of such a system (which includes sensors, directed energy weapons, kinetic-energy weapons, system analysis and battle management, and system survivability), so that a decision can be made by the early 1990's as to whether such a system can be built. If it is technically feasible, then the plan will proceed to the next phase of system development and production.

The SDI plan is based on the idea of strategic defense research proposed by President Reagan in a telecast speech on 23 March 1983.

Question: What is multilevel, multisegment defense? How is it different from previous antimissile systems?

Answer: Multilevel, multisegment defense is a systems approach to the "Star Wars" defense plan. It refers to the deployment of various detection and intercept segments of an antimissile system at many different regions in space. For example, the detection system includes infrared sensors placed in a 36,000-km orbit to detect missile launches, optical and infrared sensors placed in 8,000-24,000-km orbits to perform target tracking and discrimination, airborne optical sensors, and radars to discriminate warhead from decoys and to guide the interceptors during terminal defense, and ground-based optical sensors and radars whose function is to coordinate the operations of the other sensors. The intercept system can be divided into four levels according to different phases of the target trajectory: boost phase defense to intercept the missile booster, post-boost phase defense to intercept the bus and the warhead, midcourse defense to intercept the warhead during midcourse of the trajectory, and terminal defense to intercept the re-entering warhead. The weapons used by such a system include space-based laser weapons, neutral particle beam weapons, and nonnuclear interceptors.

Previous antimissile systems were basically single-level, single segment systems. For example, detection and guidance were carried out by microwave radars; intercepts were carried out using nuclear interceptors. The U.S. Nike-Zeus system and the Soviet Galosh system were both single-level systems. Although the Sentinel system used a two-level intercept scheme, its terminal defense was very limited. The multilevel, multisegment defense system differs from previous systems in three major aspects: (1) High probability of intercept. If the probability of intercept of each level is 70 percent, then the overall probability of intercept for a 4-level system would be 99 percent. (2) Effective discrimination capability. The different sensors can complement one another to improve the discrimination capability of the entire system. Penetration aids which cause interference for one type of sensor will not be effective against another. For example, strips of metallic foil can cause interference for microwave radars but are totally ineffective against infrared sensors. (3) Good antipenetration capability. Many interceptors have the capability to neutralize penetration weapons. For example, installing reinforcement on storage tanks can provide protection against lasers but not against high-energy particle beams. Of course, a multilevel, multisegment system also has disadvantages in that it is huge in size and very complex; it is also very expensive and highly vulnerable.

Question: Why is it possible to greatly increase the effectiveness of intercept with the new antimissile system?

Answer: The effectiveness of intercept of the new antimissile system may be greatly increased for the following reasons: (1) Boost phase intercept. Modern ballistic missiles can carry more than 10 individually guided warheads and a larger number of decoys, but they cannot be released during the boost phase. Therefore, intercepting one missile during the boost phase is equivalent to intercepting several or dozens of warheads. In addition, compared with warheads, a missile during the boost phase travels at much lower speed and is structurally much weaker so that it is easier to destroy. (2) Directed-energy weapons can destroy many targets either sequentially or simultaneously. For example, a space-based chemical laser weapon can sequentially destroy tens of missiles during the boost phase. X-ray laser weapons can destroy 50 targets simultaneously. (3) A nonnuclear interceptor is a missile with many warheads. With the development of infrared tracking and data processing technologies, it is now possible to destroy a target by direct collision between the nonnuclear warhead and the target warhead; this eliminates the need for installing high-energy explosives in the warhead and thus reduces its volume, weight, and cost. As a result, a single interceptor can be equipped with dozens of warheads, each of which can destroy a target. In other words, a new interceptor is equivalent to dozens of existing interceptors. Figure 1 shows a schematic diagram of such a warhead during an engagement.

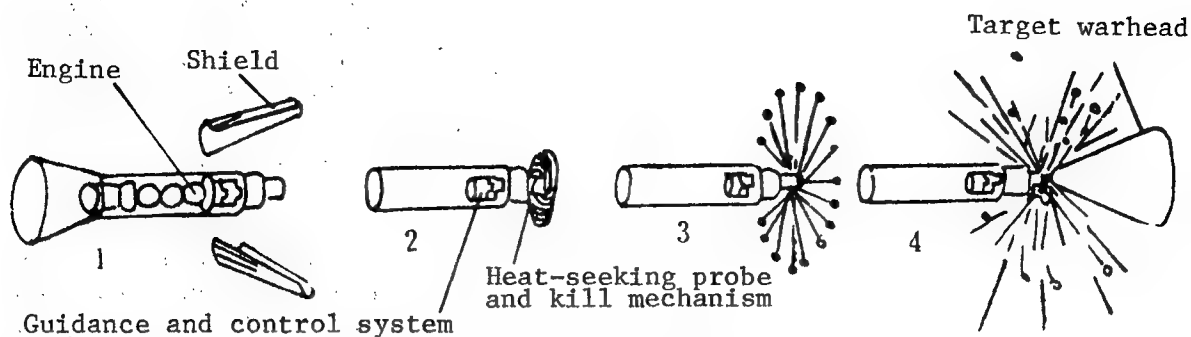


Figure 1. Schematic Diagram of Direct-Collision Type Nonnuclear Warhead During Engagement

1. Dropping of protective shield
2. Kill mechanism ready to be deployed
3. Fully opened kill mechanism
4. Collision with target

Question: What is the technical feasibility of the "Star Wars" plan?

Answer: The feasibility of implementing such a plan must be carefully analyzed. If the objective is to develop an experimental multilevel, multi-segment antimissile system in order to demonstrate the concept, then based on the current technologies and development trends, it is quite feasible, in fact it can probably be achieved in the 1990's. However, if the objective is to build a multilevel, multisection system for actual deployment, then it is difficult to predict the outcome because it not only depends on making breakthroughs in many key technology areas, but more importantly, it also involves many strategic, tactical, political, economic, and diplomatic factors.

Question: What are the key issues in realizing the "Star Wars" plan?

Answer: The key issues in realizing the "Star Wars" plan are: (1) the effectiveness-to-cost ratio of the antimissile system must be higher than that of the offensive system; and (2) the system must be able to survive with a high degree of confidence. In other words, in order to neutralize the antimissile system, the offense must pay a higher price than the defense. This is a very stringent criterion. While the development of defensive technologies within the past decade made it possible to satisfy this criterion, offensive technologies have also been advancing at a rapid pace. Therefore, to meet this criterion in reality is very difficult. Based on the current capability, the Office of Strategic Defense of the U.S. Department of Defense is taking every possible measure to achieve this goal. In order to ensure system survivability, measures of passive reinforcement and active protection are taken to ensure that the system will continue to operate effectively when subject to enemy interference and attack. This is also the criterion that must be satisfied by an actual battle system.

Question: What kind of space-based weapons are likely to be used in the "Star Wars" plan?

Answer: This plan is currently still in the phase of feasibility study, the overall system configuration and the weapons used have not been determined. However, based on current estimates, the candidate space-based weapons include the following: (1) Hydrogen fluoride chemical laser. Its output power can reach 5-10 megawatts in the near future, and it can be used with a reflecting mirror as large as 4 m in diameter. Relatively speaking, this technology is quite mature, and it probably will first be used in an experimental system for boost phase intercept. The use of such a weapon in an engagement is shown in Figure 2. (2) Neutral particle beam weapon. It has higher destructive power than a laser, and can be used for midcourse intercept, but it is not likely to be developed for near-term use. (3) Electromagnetic gun [rail gun]. It is a kinetic-energy weapon which uses electromagnetic force to accelerate the gun pellets. Based on current technology it is expected that in the near future pellets can be accelerated to a velocity of 20 km/sec. It can be used for boost phase or post-boost phase intercept. (4) Nonnuclear interceptor. It can be used for midcourse intercept.

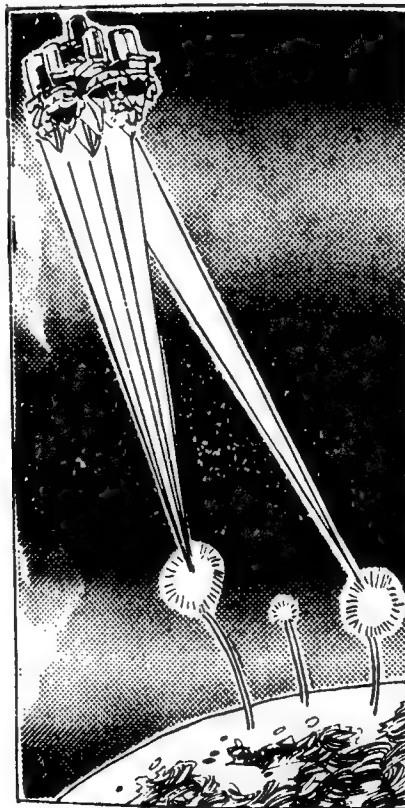


Figure 2. Operation of an Integrated Reflecting Mirror Assembly

Question: How much will it cost and how long will it take to carry out the "Star Wars" plan?



Answer: This is a difficult and controversial question because it depends on many factors which cannot be accurately determined at this time. Generally, it is considered too early to give a reliable answer to this question, but estimates by other countries indicate that a deployed antimissile system would cost several hundred billion dollars and take several decades to develop.

Question: What technological advances have been made since this plan was initiated?

Answer: It is reported that since the plan was initiated, significant advances have been made in many technical areas. For example, the new optical signal processor recently tested in the United States has a processing speed 5-10 times faster than current processors, and is superior in terms of survivability.

The integrated reflecting mirror assembly which was recently tested on the ground has a combined diameter 10 times larger than the largest reflecting mirror in existence. The so-called integrated reflecting mirror assembly consists of a group of properly arranged small mirrors which are designed to reflect the incoming laser beams synchronously to form a highly intense coherent light, thus producing the same effect as a single large mirror. It provides an alternate means to replace a very large reflecting mirror (see Figure 2).

In June of this year, a laser tracking system to be used for the Star Wars plan was tested for the first time on the space shuttle. The small reflecting mirror installed on the window of the space shuttle successfully reflected the low-power laser beam emitted from Hawaii.

In March of this year [1985], an underground X-ray laser experiment conducted in Nevada indicated that by using a specially designed instrument, it was possible to focus a nuclear excited X-ray laser and greatly increase its intensity. In addition, the United States has conducted electron-beam transmission tests using an advanced experimental accelerator in a sealed enclosure. It is expected that in the near future it would be possible to establish the feasibility of transmitting electron beams through the atmosphere.

Current tests have shown that an electromagnetic emitter can accelerate a plasma to a speed of 10 km/sec, which fully demonstrates the huge potential of this technology. Also, tests of electronic equipment have been conducted under launch loads of as high as 100,000 g's.

The U.S. Defense Advanced Research and Planning Agency recently developed a new antilaser material which is one or two orders of magnitude stronger than the structural materials used on the space shuttle.

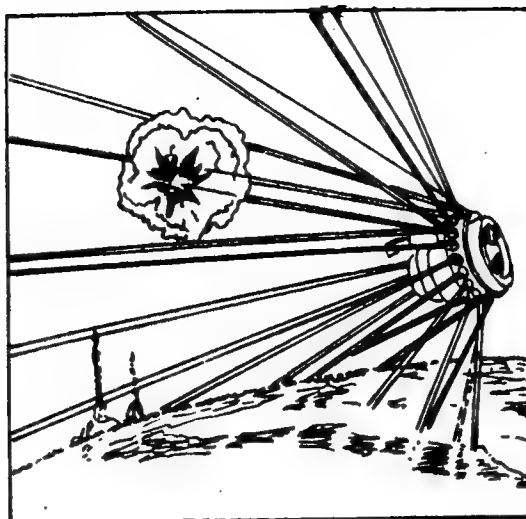


Figure 3. X-ray Laser Weapon in Action

Question: What is the objective of the U.S. "Star Wars" plan?

Answer: The main objective of the U.S. "Star Wars" plan is to gain military superiority and to accelerate the development of high technology which in turn promotes economic development. After many years of competition, the United States and the Soviet Union have reached a stalemate in terms of offensive strategic weapons. Further tests in this area not only will require a large amount of investment from both sides, but neither side will be able to gain superiority over the other. The United States believes that it is ahead of the Soviet Union in the key technology areas of strategic defense, therefore it is to its advantage to channel the competition to this area. Furthermore, this plan will also promote the development of such technologies as directed energy, aerospace, and sensors, which have direct application in various aspects of the national economy. For example, a new material developed under this plan is five times superior than similar materials currently in use; it can improve the performance of electric capacitors.

Question: What is the Soviet Union's evaluation of the "Star Wars" plan?

Answer: The Soviet Union believes that the United States is pursuing the "Star Wars" plan with the intention of carrying out a first strike, and forcing the Soviet Union to disarm under both offensive and defensive nuclear threat by the United States. Of course, the Soviet Union will not allow this to happen; it will certainly take appropriate measures to improve its defensive and offensive capabilities. Therefore, this plan will upset the strategic balance between the United States and the Soviet Union, accelerate the arms race, and threaten world peace.

From the technical point of view, the Soviet Union has changed its position. Initially, it considered the plan to be unfeasible. Then, it believed that an antimissile system of this type cannot be 100 percent effective, and its cost will be prohibitive. However, in January of this year, the Soviet physicist

and Nobel Prize winner, Nikolai Bosov, said that scientifically, there is no inherent difficulty in developing a space-based laser for intercepting missiles. The Soviet Union should have no major technical problem in developing a "Star Wars" system similar to that of the United States.

Question: What countries have been invited by the United States to participate in this plan? And what are their attitudes?

Answer: The countries invited by the United States to participate in the "Star Wars" plan include the NATO countries (England, France, West Germany, Italy, the Netherlands, Belgium, Luxemburg, Denmark, Norway, Iceland, Portugal, Spain, Turkey, Greece, and Canada), Australia, Japan, and Israel.

At the time, the countries which have clearly announced their intention to participate include England, West Germany, and Canada; those which definitely will not participate include France, Australia, Denmark, and Norway. Japan indicated that it will only participate if others do not. Italy could not make up its mind, and the Netherlands expressed doubt about the validity of this plan.

3012/9365

CSO: 4008/22

APPLIED SCIENCES

SPECTER OF WAR IN SPACE DISCUSSED

Beijing HANGTIAN [SPACEFLIGHT] in Chinese No 5, 1985 pp 13-15

[Article by Bao Xianmin [7637 7359 6900]]

[Text] Artificial satellites, space shuttles, manned space stations...the products of aerospace technology are unlimited. This technology has been developed primarily from military aerospace applications. Among the more than 3,000 space vehicles launched to date, 70 percent are military satellites. The topic to be discussed in this article is the space war between the United States and the Soviet Union, specifically its current status and future prospects.

(I) Ballistic Missile Defense System

The velocity of an ICBM is approximately 7 km/sec; therefore it takes less than 30 minutes to cross the North American continent and the Europe-Asia continent. In attacking its target, it first penetrates the dense atmosphere and rises to an altitude of 1,000 km, then it glides through space before re-entering the atmosphere and flying toward the designated target. Therefore, the success or failure of future warfare is determined by how to use antimissile weapons in space and in the atmosphere to destroy the incoming missiles. Reagan's "Star Wars" plan is to establish an antimissile, antisatellite shield in space to protect the U.S. mainland from nuclear attack.

The duration from launch of an ICBM to cut-off of all stages of rocket engines is called the "power flight phase." It only lasts 2-5 minutes but the initial battles will take place during this short period.

The launch of ICBM's is being monitored by early-warning satellites in a 35,800-km geosynchronous orbit. It is equipped with extremely sensitive infrared remote sensors, which can detect and track the plume of a rocket engine within 90 seconds of a missile launch, and send a warning to the command center within 2-3 minutes.

The actual intercept of the ICBM's is performed by offensive satellites orbiting at an altitude of 1,000 km. This is an appropriate altitude because at higher altitudes it would be difficult for the satellite to accurately destroy an ICBM traveling at high speed. To intercept missiles launched from all possible launch points including nuclear submarines, at least 50 offensive satellites must be deployed.

An offensive satellite is equipped with X-ray laser and chemical laser weapons as well as particle beam and directed-energy weapons. It is an extremely complex and gigantic weapons system. First, a beam emitted from the ground is reflected through the mirror on the satellite to search for incoming target; then the missile or its electronic equipment is destroyed either by heat or by shock waves. Within its effective range, an offensive satellite can destroy an ICBM in fraction of a second. Therefore, this type of directed-energy weapon can discriminate, aim, and destroy its target almost in an instant.

Relatively speaking, an ICBM travels rather slowly during the power flight phase, and hence is most vulnerable. Also, since the individually targeted multiple warheads are still in the same compartment, they have a high probability of being destroyed.

The ICBM's which have survived the boost phase are to be destroyed during mid-course in space. During the terminal phase, a few warheads which have leaked through both the boost phase and the mid-course phase to re-enter the atmosphere must be intercepted by airborne or ground-based antimissile interceptors at an altitude of 15-45 km. The probability of destroying a target in each phase can be as high as 90 percent, hence the number of ICBM's that can escape such a "multilevel defense system" is less than one in a thousand.

The United States has allocated approximately \$1.7 billion in FY 1985 research funds to develop a "ballistic missile defense system" for the future "Star Wars." In fact, a strategic defense system which contains many different types of reconnaissance and monitoring satellites has already been established.

## (II) Particle Beam Weapons

In spring 1977, an article published in AVIATION WEEK provided considerable ammunition to the on-going debate about the development of particle beam weapons. The article was based on the testimony of the ex-U.S. Air Force Intelligence Chief, Brigadier General George J. Keegan, which pointed out the progress made by the Soviet Union in preparation for space war and the lack of a definite U.S. counter policy. Keegan's testimony stated that the Soviet Union had initiated research in particle beam weapons, and would begin actual deployment in the 1980's.

Keegan's testimony was based on conclusions obtained from the analyses of intelligence information gathered by U.S. military satellites. U.S. early warning satellites had detected dust clouds and heat energy associated with nuclear explosions in the central Asia region of the Soviet Union near Semipalatinsk. Photographic reconnaissance satellites also showed the presence of a mysterious spherical steel structure near Semipalatinsk, and a tank car carrying liquid hydrogen parked on the railroad. Liquid hydrogen is an essential material for a particle beam generator. The Air Force Intelligence Office therefore predicted that there is a Soviet particle beam weapon research facility at Semipalatinsk.

Although most people were skeptical about Keegan's testimony, the debate about particle beam weapons turned out to be a primary force for accelerating the development of particle beam weapons in the United States.

Particle beam weapon is a weapon which accelerates charged particles or electrons to near the speed of light and uses the beam to destroy its target. Like the laser weapon which uses infrared electromagnetic beams, it is a representative member of directed-energy weapons. In addition to generating heat energy to destroy its target, the particles themselves have considerable destructive power. As long as the beam hits the target, it can be more effective than a laser weapon. There are two ways to use particle beam weapons: one is to install it on an offensive satellite to destroy ICBM's in flight; the other is to install it on the ground or on a ship to intercept warheads re-entering the atmosphere or cruise missiles. However, there are many difficulties that must be overcome before particle beam weapons can be used in space.

The accelerator which provides the source of kinetic energy for the particles is a device which attracts charged particles to the positive magnetic poles. Since all particles are electrically charged, they tend to repel one another. Once the charged particles are emitted from the accelerator, the particle beam begins to diffuse. Even if the beam is transmitted without diffusion, its direction of transmission will change in an irregular manner due to the effect of the earth magnetic field. Therefore, there is an inherent difficulty in building a weapon using charged particle beams.

But what happens if the accelerated particles become electrically neutral particles? A beam of neutral particles 2 cm in diameter will diffuse to 20 m after traveling a distance of 1,000 km. In order to have very high destructive power, a structure of the size of an aircraft carrier must be built in space to provide a sufficiently large power source. This is difficult to achieve in reality.

Consequently, while particle beam weapon may become a reality some day, at present it can only be used within the atmosphere and is limited to a range of several kilometers. For this reason, the United States announced in 1980 that the focus of current development of directed-energy weapons is on laser weapons, not particle beam weapons.

### (III) Laser Weapons

In 1975, malfunctions developed on the U.S. early warning satellites located above the Indian Ocean. An investigation revealed that they were caused by infrared emissions from the western Soviet Union which exceeded the safety limit of infrared sensors on the satellites. Later, similar malfunctions occurred on reconnaissance satellites passing over the Soviet Union. However, the electronic equipment on the satellites continued to function normally. The possibilities of "volcano eruption" and "forest fires" were finally eliminated and the hypothesis of a "Soviet laser emission" became the leading candidate. It so happened that the optimum wavelength for surveillance by the infrared sensors was very close to the wavelength of laser weapon being developed by the Soviet Union. This caused a major uproar in the United States because

there were speculations that the Soviet Union conducted an exercise of offensive satellites.

Shortly afterwards, the U.S. Government announced that the series of mysterious phenomena were caused by fires in the Soviet natural gas pipelines. Although the incident was over, the true facts are still unclear.

The key issue in building a directed-energy weapon to be used in space is to develop laser weapons which use electromagnetic beams such as infrared or X-rays. Based on current technologies, while particle beam weapon seems to be only a pipe dream, laser weapon is not, although it also has its technical difficulties.

In generating a laser beam, energy is given to the molecules of a certain material so that the molecules are elevated to an unstable state; when they return to their original state, an electromagnetic wave is emitted. Laser can be generated from molecules in either a solid, liquid, or gaseous state. But there are only three types of high-energy lasers that can be used as weapons: gas lasers, electron-beam controlled discharge lasers and chemical lasers. They have different mechanisms in laser production; for example, a gas laser is generated by the sudden expansion of high-temperature carbon dioxide produced from burning fuel.

A laser weapon uses heat energy to destroy its target. To burn through a piece of metal plate 2-3 mm thick, 1,000-10,000 joules of heat energy must be concentrated in each square centimeter. If target reflectivity is taken into consideration, then 10 times this amount of heat energy would be required. If we use a pulse laser with a pulse width of fraction of a millisecond to hit a target 1,000 km away, and the aperture of the aiming lens is 1 m, then the required laser output power is equivalent to 1,000 nuclear power plants each with 1 million kw capacity. Of course, these are only theoretical estimates.

If a larger aiming lens is used to focus the laser before it is emitted, a very high energy beam can be produced even though the output power is lower. Therefore, as part of the future plan, the Advanced Research and Planning Agency of the U.S. Department of Defense is considering the production of a 10-m aiming lens, which requires only 1 percent of the power of a 1-m aperture lens to achieve the same destructive power. However, one of the questions that must be answered is whether such a large aperture lens can capture a target traveling at high speed. If it cannot accomplish the tasks of aiming and illuminating the target in an instant, then it will not be effective in a space war.

Last year, the U.S. Air Force announced that an airborne laser weapon successfully destroyed a missile traveling close to the speed of sound. Although this weapon is a long way from a laser weapon to be used in a space war, it did demonstrate the feasibility of such a laser weapon provided current technologies continue to develop rapidly in the future. (To be continued)

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CSO: 4008/22

## APPLIED SCIENCES

### ANTIMISSILE INTERCEPTOR DESCRIBED

Beijing HANGTIAN [SPACEFLIGHT] in Chinese No 5, 1985 p 9

[Article by Ma Baoren [7456 1405 0088]]

[Text] The so-called "Star Wars" plan of the United States is a multilevel strategic defense plan against enemy ICBM attack. It contains such weapons as antimissile satellites, free-electron laser system, antimissile interceptors, and particle guns. In order to implement this "Star Wars" plan, the United States has invested a substantial amount of human and material resources and has conducted numerous flight tests. On 10 June 1984, it successfully completed a flight test of antimissile interceptors.

Figure 1 shows the main events of this antimissile interceptor test. First, a missile is launched from the Vandenberg Air Force Base in California to emulate an attacking Soviet ICBM. When the warhead is flying toward the Kwajalein target area in the Marshall Islands, the search radar of the ground-based antimissile system acquires the target and notifies the "antimissile unit." Once the unit receives the command, a laser-guided homing missile is launched from (meike) [Meck?] Island in the middle of the Pacific Ocean to intercept the "enemy" missile. After reaching the upper atmosphere, the booster rocket separates from the interceptor. Then, relying on its own guidance system, the interceptor flies in the direction toward the target, so that the kill device of the interceptor is aimed at the target. If the target is still far above the atmosphere, the infrared sensor and the guidance computer on the interceptor will automatically start tracking the acquired target. The infrared sensor has such high sensitivity that against the cold background of the universe, it can detect an object at human body temperature 1,000 miles away. Therefore, a nuclear warhead traveling at high speed in space can be easily detected.

Armed with highly sensitive and accurate tracking and guidance systems, the interceptor races toward the target at a speed of approximately 15,000 miles per hour. In order to increase its kill radius, a 15-ft metal net located at the neck of the interceptor suddenly opens up like an umbrella just before impact. Every rib of the metal net is equipped with heavy metal objects (see Figure 2). When the high-speed interceptor collides with the warhead which is also traveling at full speed, the relative velocity can be as high as 20,000 ft/sec. Colliding head-on at such great speed, the "enemy" warhead simply disintegrates.



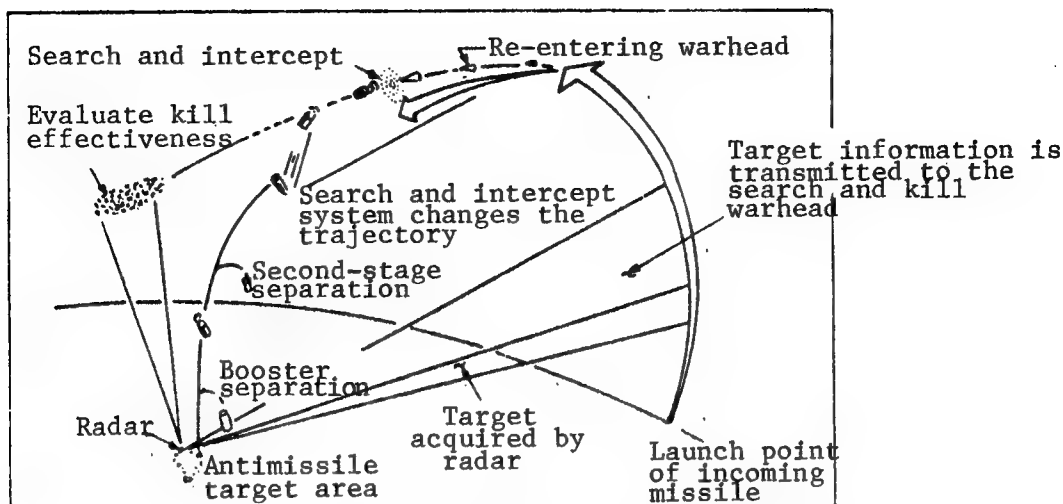


Figure 1. Antimissile Intercept Test

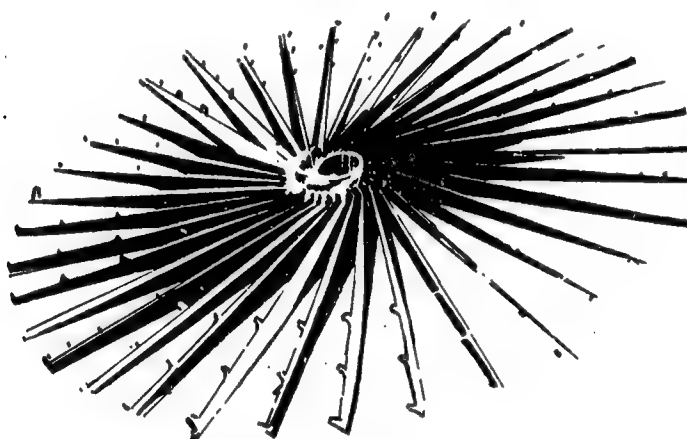


Figure 2. Umbrella-shaped Metal Net Released by Interceptor

To evaluate the effectiveness of the intercept, the United States used ground-based monitoring radars, optical sensors, and specially equipped airplanes. The recordings from these equipment all verified that this intercept test was a success.

As the saying goes: "Failure is the mother of success." The success of this intercept test was preceded by a number of failures and setbacks. The first setback occurred on 7 February 1983, when a slight malfunction in the cooling system of the sensor caused failure in the search system and resulted in test failure. During the second test on 28 May, while the search function was successful, problems were encountered in the guidance system, causing loss of target and another test failure. On 16 December, a third test was conducted, but the trouble developed in the computer software, which prevented the sensor data from being converted into control commands; as a consequence, the interceptor missed the target, and naturally the warhead failed to detonate.

This test is the fourth attempt. Although it was a successful test, intercept technology must be further improved to keep up with the developing missile penetration capability. The whole world is watching the United States and the Soviet Union perform various tests to gain control of space.

3012/9365

CSO: 4008/22

APPLIED SCIENCES

AERONAUTICS INDUSTRY SEES BOOM IN SEVENTH FIVE-YEAR PLAN

HK201426 Beijing ZHONGGUO XINWEN SHE in Chinese 0332 GMT 20 Dec 85

[Text] Beijing, 20 Dec (ZHONGGUO XINWEN SHE)--China's aeronautics industry is now developing at an unprecedented speed. Dozens of new types of aircraft, including fighters, bombers, attack planes, helicopters, transports, and passenger planes have been produced in China, and the Sixth Five-Year Plan thus became a period in which China developed and produced the most new-type aircraft.

This was revealed by Mo Wenxiang, minister of aeronautics industry. He said: "From the summer of last year to the first 6 months of this year, three of the newest types of fighters flew into the blue sky. Now, formal production of these aircraft has begun. This has set the record for high-speed trials and production in China's aeronautics history."

In December, the Ministry of Aeronautics Industry received one piece of good news after another: The Chinese-made "Yun-7" and "Yun-12" passenger planes, which were refitted in Hong Kong, flew back to Beijing. Chinese leaders Wan Li, Li Peng, and Hu Qili went to inspect and ride in these planes. So many party and state leaders paying such special attention to the production of planes and supporting this industry has rarely been seen.

On 3 December, the Yun-8 "Black Eagle" plane succeeded in a trial flight and carried an American-made helicopter to the southwest border area. On 11 December, a successful trial flight of the "Zhi-8" helicopter was reported from Jingdezhen City. The helicopter will be produced formally and will be used for the purposes of transport and rescue operations.

The rapid development of China's aeronautics industry during the Sixth Five-Year Plan cannot be separated from China's policy of opening up to the outside world. We would not have produced so many aircraft if we had closed our door. We cooperate with foreign manufacturers in making both military and civilian aircraft. Now, China has cooperated with the United States in making the MD-82 which can carry 150 passengers. China has also imported the technology to make "Dolphin" helicopters, and has established cooperation deals with Britain and the FRG.

China has achieved good results in expanding exports of aeronautics products. At present, we have export trade relations with 32 countries and regions and have sold many types of aircraft engines, and other plane parts to foreign countries. We have received foreign orders for hundreds of light helicopters.

In the Seventh Five-Year Plan, China's aeronautics industry will reduce the production of military products and concentrate its strength on producing hundreds of civilian aircraft to satisfy the domestic demand. China will continue to import new foreign technologies, including electronic guidance systems and cabin equipment. A situation in which China cooperates with foreign countries in making aircraft on a large scale will appear in the Seventh Five-Year Plan.

/8309

CSO: 4008/31

APPLIED SCIENCES

NEW AIRCRAFT DEVELOPED BY AVIATION INDUSTRY

OW200924 Beijing XINHUA in English 0826 GMT 20 Dec 85

[Text] Beijing, 20 Dec (XINHUA)--China has improved its air force armament with new aircraft models developed by itself since 1981, the first year of the current 5-year plan period.

These include bombers, helicopters, fighters, attack planes, trainers and unmanned planes, according to the Ministry of Aviation Industry.

In addition to military planes, China has built six types of passenger and transport planes including Yun-7, Yun-8 and Yun-12.

The 52-seat Yun-7, the first Chinese-made passenger plane, is now flying domestic routes.

The Yun-12, a light, multi-purpose, high-wing monoplane, is for short-haul cargo and passenger transport, the ministry said.

The aviation industry, which used to serve military needs only, is also producing goods for civil use including household appliances. The output value of such goods accounts for 40 percent of its total.

China now sells aircraft and other products to more than 30 countries.

/8309

CSO: 4008/31

## APPLIED SCIENCES

### STATUS OF AIRCRAFT ENGINE RESEARCH AT NPU REVIEWED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 10, Oct 85 pp 4-6

[Text] The aircraft engine research work at NPU [Northwest Polytechnic University] is intended to satisfy the needs of national defense and the aviation industry on the one hand, and to serve China's economic development on the other. We have devoted our efforts to the following two areas: (1) exploring advanced design methods of high-performance propulsion systems, studying new topics in jet propulsion technology, developing our experimental capabilities and striving to improve measurement techniques; (2) providing wide range of technical services to the mechanical, power, energy exploration and local industries in the areas of product design, application of new technologies, and development of new energy sources. Since 1977, we have made significant progress in more than 30 research topics, four of which received national science awards, and one received the fourth prize of the national award for scientific and technological inventions.

Modern jet propulsion technology is closely tied to state-of-the-art scientific development and the development of electronic computers; it has evolved from a single technical discipline to the combined study of many different disciplines. In recent years, this department has devoted its efforts in the following areas of research.

#### Performance Evaluation of Propulsion Systems and Application of Computers

In recent years, this department has organized a special working group to study topics in computer simulation of engine performance in order to provide practical, efficient analytical tools for modifying old engines and designing new ones. The topics include:

(1) application of computers to perform numerical analyses of flow fields in air intakes and jet nozzles, and of the overall flow field which includes the air intake as well as the interior and exterior of the fuselage; (2) computer study of the steady-state and transient performance of the engine, and prediction of transient engine performance in a nuclear explosion; and (3) study of the effect of distortions in air intake (e.g., shock waves, launching of weapons) on engine performance. In addition, a complete set of computer programs have been developed for analyzing the effect of engine installation in a propulsion system; this software is also being extended to provide an overall design tool which takes into consideration both engine performance and aircraft performance.

A key issue that must be resolved in the design of high-performance propulsion systems is the problem of air intake/engine compatibility. During a high-mobility flight of a supersonic aircraft (e.g., long sideslip, large angle-of-attack/pull-up, small-radius fast turns, etc.) when the air intake may suck in waste gas, surge, or operate under supercritical conditions, non-uniform or pulsed pressure disturbances will appear in the flow field. As a result, the stability margin is significantly reduced; in the worst case, the engine may stall or surge. Currently, a great deal of efforts are being devoted to the study of the effect of distortions in air intake on engine stability. In this department, we have completed the following tasks: measurement of aerodynamic parameters along the flow path of a single-axle turbo-jet engine; simulation of flow field distortion in the air intake on a full-scale engine test stand by using a metal screen to produce steady-state distortions and a back plate to produce turbulent transient distortions; measurement of the effect of steady-state distortion on compressor characteristics and the inter-stage parameters of a compressor under steady-state flow conditions; experimental and theoretical studies of engine instability under steady-state and transient distortions in the air intake, engine surge and its effect on engine structure, and prediction of the effect of intake distortion on the stall margin of a single-axle turbojet engine. We have developed a complete steady-state and transient pressure measurement system and its associated calibration equipment; we have also carried out measurements and data processing for distorted flow fields, and developed a simple statistical method to predict the maximum instantaneous distortion spectrum.

#### Study of Design Methods for High-Performance Compressors

The axial-flow compressor is considered to be the most difficult component to design in the gas turbine engine. The major requirements for an axial-flow compressor of a high-performance propulsion system are: operational stability, high pressure ratio between stages, small number of stages and high efficiency. This requires in-depth study of the complicated phenomena of fluid mechanics inside the impellers. It must address not only the problem of shock wave interference caused by supersonic and transonic flows inside the impellers, the problem of boundary layer effect due to flow viscosity, and the blade selection problem, but also problems of non-steady flow which lead to aerodynamic loss, blade flutter, and compressor stall and surge. In the early 1950's, a three-dimensional aerodynamic design method was proposed which considered viscous, compressible non-steady flow inside the axial-flow compressor; it actually treated the three-dimensional flow as a combination of two two-dimensional flows consisting of  $S_1$  and  $S_2$  flow surfaces. Within the last decade, this method has been further improved as a result of the development of computers and the discovery of new methods of solving time-varying equations of motion.

In this department, positive results have been obtained in applying the method of similar flow fields and the streamline iteration method to solve for the  $S_1$  flow surface and using the method of streamline curvature and the method of open flow and pipe flow to solve for the  $S_2$  surface. These results can be used to calculate the cascade motion when viscosity is taken into account, to predict flow field loss and flow direction at the exit of the cascades. Efforts have been initiated to study methods of calculating boundary layer over annular

walls in order to estimate secondary losses of the cascades and to select the blocking coefficient of boundary layer over annular walls. The circular-arc blade design currently under study will also play an important role in the design of high-performance compressors.

#### Study of the Stability of Axial-Flow Compressors

Instability in the operation of axial-flow compressor, i.e., stall and surge, will lead to degradation in engine performance, cause engine vibration and blade flutter, and may even result in engine stall in mid air. In other countries, studies of compressor stall and surge have been devoted to not only theoretical predictions but also practical measures of preventing stall and surge. In 1977, the United States developed a stall warning system using the speed of rotation and turbine temperature as input signals. The Soviet Union had installed a surge pressure sensor and fuel cut-off and supply mechanisms on the P29-300 engine. Research efforts have also been devoted to extend the stability region of compressor operation, and the results are now being implemented in practical applications. For example, the Soviet P13-300 and P29-300 engines are both equipped with processing cartridges; the French "(Ata)" 9K-50 engine has stabilizing vortex generators located at the compressor inlet; the British Rolls Royce Co uses a bent stator blade design to extend the stability region of the compressor of the RB211 engine.

In this department we have conducted experimental research on topics of compressor stall surge and rotor trails on the compressor test stand; achievements have been made in determining the axial attenuation along the blade trail, predicting the stall point using perturbation theory, and estimating the stall boundary and stall margin of blade arrays. We have also studied the mechanism of stability enhancement using processing techniques, and have proposed a method of stall point prediction. We have studied in detail processing techniques using circumferential-groove type cartridges and have demonstrated its effectiveness in stability enhancement. Experiments have been conducted on the creation of engine stall and surge, and the determination of surge boundary (surge is created by reducing the nozzle size and the area of the first-stage guide vanes and spraying water in the combustion chamber). A non-linear theoretical model was also developed to predict compressor stall. In addition, based on in-depth studies of single-stage compressor characteristics, research efforts were initiated to determine the surge boundaries and stall points of multi-stage axial-flow compressors under steady-state and transient conditions, to develop surge prevention and stall warning systems, and to develop measurement techniques for non-steady flow in the compressor. The problem of blade flutter is also being studied based on the theory of aerodynamic excitation and elastic vibration.

#### Theory of Combustion and Experimental Research

Combustion research is concerned with such problems as the performance and efficiency of combustion equipment, the use of replacement fuel, and pollution of exhaust gas.



In this department we have devoted our efforts to the study of such problems as the flow structure of the combustion process, fuel atomization in the combustion chamber, two-phase combustion, and combustion characteristics; we have also devoted efforts to the development of turbulent combustion theory and associated numerical techniques, as well as to the research of experimental techniques. We have studied the stability problem of gas-phase and two-phase combustion, the modeling of combustion chamber of gas turbines, numerical analysis of pressure expansion devices in the combustion chamber, analysis of concentration fields of liquid combustion, analysis of the flow field of two mixed gas streams in a supercharged combustion chamber, and simulated test of supercharged combustion chamber. The numerical calculation of three-dimensional, two-phase, turbulent response flow field is a problem of current investigation; the objectives of this investigation are: (1) to understand the mechanism of turbulent combustion; (2) to establish a reasonable physical model and to develop the corresponding computational procedure; (3) to obtain experimental data on interference structure of turbulent combustion; and (4) to propose measures of combustion enhancement and computer-aided methods for designing combustion chambers. Another current research topic is the study of flow structure and fuel distribution inside the combustion chamber; its objective is to analyze the turbulent parameters the velocity field and the concentration field in the combustion chamber and to establish a flow model in the head section of the combustion chamber and develop the corresponding computational procedure. In the area of two-phase combustion research, we plan to gain a better understanding of the laws of motion and variation of two-phase flows and to measure the spatial distribution of particles through experimental means, and then to develop computational methods for treating two-phase combustion problems. In the area of experimentation, we plan to use pulse laser holographic techniques.

#### Prediction of the Life of High-temperature, Air-cooled Turbine Blades

It is estimated that by 1990, the turbine temperature in high-performance propulsion systems will reach 2000°K. To ensure reliable operation of these high-temperature turbine blades requires the following measures: designing new blade cooling structures, and developing fast-cured powder alloy and tungsten fiber reinforced heat resistant alloy composite materials. For these turbine blades, the problem of strength and heat conduction analyses and the problem of life prediction under the actions of creep and fatigue have become research topics which are of great interest both in this country and abroad.

This department has conducted research on this topic in the areas of computational methods, theoretical analysis, and experimental techniques. Specifically, finite element methods have been used in three-dimensional elasto-plastic stress analyses and temperature field calculations. A complete set of computational programs have been developed to allow automatic discretization of turbine blades with complex shape and cooling hole designs; studies are underway to explore the use of electrical and optical measurement techniques to verify the calculated results. Efforts are also underway to develop methods of predicting the life of high-temperature, air-cooled turbine blades by using local stress-strain techniques and by taking into consideration temperature effect and creep effect as well as the effects of actual load spectrum and environmental factors. In addition, the research also includes developing new experimental techniques and methods of heat transfer calculations for air-cooled turbine blades.

## Vibration Studies of Engine and Engine Parts

Vibration of engine and engine parts is still a very important problem in high-performance propulsion systems. In recent years, advances in vibration theory, particularly in rotor dynamics and mode analysis techniques provided powerful tools to solve this problem. In this department, we have performed dozens of vibration measurements on a certain engine model by using modern vibration signal analysis methods, and used the results to study vibration monitoring techniques and test stand/engine balancing techniques. We have studied the theoretical problem of tuning the rotor precession rate of a cantilevered turbine engine, and revised the specification for vibration measurement of this engine model. As a result, the rejection rate of this engine due to excessive vibration during test was reduced by 12 percent; the resulting savings in test fuel and labor hours lowered the production cost significantly. In addition, we have proposed the direct integration method using transfer matrices for determining the critical speed of a rotor-bearing system, the vibration modes, the non-equilibrium response, and for stability analysis; we have also obtained positive results in the theoretical and experimental research of vibration monitoring of crack development in turbine axles.

Measurements of blade vibration frequencies on a particular engine model have been made and statistical analysis of the data have been performed to establish preliminary specifications of standard blade vibration frequencies. We have studied the effect of flow field distortion on blade vibration, and obtained good results from the analysis and diagnosis of blade failures in a particular engine model. Based on studies of the frequency mismatch problem in blade vibration which is of great current interest, we have made the suggestion that in frequency-grouped blade assemblies, the frequency error should be controlled to within  $\pm 2$  percent.

## Study of Engine Control Using Digital Computers

The development of high-performance propulsion systems places higher demand on control systems. The system should be designed not only to control the engine, the air intake, the rotary wing, the propeller, but also to interface with the flight control system. The control functions include regulating, maneuvering, monitoring, and protection, data collection and processing, performance display and fault diagnosis. As a result of recent development and application of digital computers and modern control theory, multi-variable non-linear control devices can be implemented on aircraft propulsion systems. During the past decade, engine control technology using digital computers has progressed from conceptual design, research and development to practical application.

In this department, we have initiated research on digital-computer engine control technology since 1974; in 1977, we completed the experimental research of constant speed control system as well as acceleration and deceleration control on a single-axle turbojet engine. We have also carried out theoretical and experimental research in the areas of digital simulation and mathematical modeling, control laws for turbojet engines, method of recognizing linear, multi-variable dynamic air intake/engine models and power plant models, control

equipment, and microcomputer controls. We have built a dynamic simulation test platform which can be used to perform hybrid simulation tests for engine speed control systems. Recently, we have constructed a test platform specially designed to conduct tests of a digitally controlled turbofan engine. This platform can be used to study the feasibility of various designs of digital computer controls.

#### Study of Data Collection and Processing Techniques

Digital signal processing is a newly developed technology. This department began organizing a research team in this area in 1973; since that time, they have successfully developed the 114F system, the 114FB system and a data collection and processing system primarily for testing the 622 engine. These systems have been used for collecting and processing distorted flow field data of engine air intake. In 1982, we imported the PS-600 Fourier analysis system to be used for resonance analyses and tests of aircraft wings; we have implemented time-domain modal analysis techniques such as the ARMA and the Ibrahim techniques, and developed an adaptive filter pre-processor which significantly extended the range of application of time-domain methods. In the future, we shall continue to improve equipment performance, become proficient in various analysis techniques and apply new modal parameter recognition techniques for studying the dynamics of aircraft and aircraft engines.

3012/8918

CSO: 4008/17

## APPLIED SCIENCES

### SHANGHAI'S OUTDOOR AEROENGINE TEST FACILITY DETAILED

Beijing HANGKONG ZHIZAO GONGCHENG [AVIATION PRODUCTION ENGINEERING] in Chinese  
No 7, 1 Jul 85 pp 1-4

[Material provided by the Aeroengine Laboratories, Shanghai Aeroengine Plant]

[Text] In November 1983, the outdoor test facility of the Shanghai Aircraft Engine Factory was officially certified by the technical certification conference sponsored by the National Defense Science and Engineering Committee, and was named the "Shanghai Outdoor Test Facility for Aircraft Engines." As China's first outdoor test facility, it was designed to perform the essential functions of new engine development, verification of engine performance, establishing momentum corrections for indoor test facilities, and studying the effect of weather and environmental conditions on engine performance.

#### Geographic Location and Climate Conditions for the Facility

The outdoor test facility is located at 121°30' East longitude and 31°30' North latitude, the bearing of the test stand is 285°, i.e., the axis of the air intake is 15° north of due West. The absolute elevation of the outdoor stand is 3.868 m, the geometric elevation of the engine center line is 3.5 m, and the local gravitational acceleration is  $979.455621 \pm 0.000620$  gals.

According to statistical data from the Shanghai Weather Bureau, the yearly average barometric pressure is 762 mm Hg, the monthly average barometric pressure varies from 752.9 to 769.4 mm Hg; the yearly average temperature is 15.7°C, the temperature range is between -9.4°C and 38.9°C; the yearly absolute temperature is 12.2 mm Hg, ranging from 4.6 to 23.1 mm Hg; the monthly average relative humidity is 75-84 percent.

The above information shows that there are a large number of "standard days" at the test facility.

#### Structure of the Test Stand

The test stand of the outdoor facility has a suspension type structure. It consists of a fixed frame, a moving frame, and a transfer frame.

The fixed frame is a 4-column "II" shape box structure, the columns are not only anchored to the base with 16 anchor bolts, but also welded to a steel plate which is buried and welded to the base steel rib structure, then concrete is poured over both the structure and the base. Prior to assembly of the test stand, the base of the stand is prestressed to 200 tons with an effective period of 6 months. Also, the mass center of the base is designed to be offset from the center of gravity of the test stand to provide weight compensation when the stand is subject to forward thrust. The base is surrounded by an isolation ditch to minimize the effect of the factory buildings.

The moving frame is suspended to the fixed frame via four leaf springs on all four sides (545 x 200 x 20, the thinnest spot is 4 mm). Load sensors and correction sensors are installed on the axis of symmetry between the moving frame and the fixed frame.

The transfer frame is used for lifting and installing the engines. It not only facilitates the installation and removal of engines, but also serves as a separating surface if the test stand is to be modified for handling different types of engines.

The test stand is situated in a 48 x 24 m<sup>2</sup> area over a terrazzo floor; the right side of the test stand is 15 m from the factory buildings.

To meet the needs of installation, adjustment, and maintenance, the test facility has a hydraulic platform with a 5-ton capacity. During test the platform is lowered to a position flush with the base floor.

A 10-m tall roof structure is constructed to protect the test equipment and to provide improved test conditions. In order to avoid interference with intake conditions, the roof is made of cantilevered steel structures, which also serve as protection against lightning.

The overbridge used to erect the roof structure can be used by test personnel to reach the test stand; it also provides a convenient means for installing auxiliary pipes, control cables, and lead wires for measuring instruments and control devices. To allow for thermal expansion, the overbridge is fixed on one end and free to move on the other.

#### The Test Stand System and Major Components

The test stand system and the major components can satisfy the basic needs of testing different types of turbofan and turbojet engines. They include the test stand, the fuel supply system, the oil seal system, the air supply system for engine starting, the measurement system, the air suction system, the hydraulic pump loading system, the heat dissipation system, the high-speed pipe connector, the reverse thrust starting system, the de-icing system, the fire extinguishing system, the control system, the emergency power supply system, the hydraulic thrust correction system (counterbalance correction device to preserve the thrust for sensor preloads), the jet nozzle control system, the evacuation system, the electrical engine starting system, the

boost blower system, and the oil draining system. These systems provide the capabilities necessary for a multifunction outdoor test facility.

#### Aerodynamic Test

In order to ensure that airflow entering the engine is as close to the undisturbed condition as possible, the engine is situated 3.5 m above the ground and 6.3 m from the roof; also, the engine is suspended in such a way that the air intake extends forward of the test stand by a distance no less than 1.5 times the intake diameter to minimize the "test stand effect."

The following observations are made from repeated flow field measurements of the JT3D-7 P670806 engine: when the flow rate reaches 214 kg/sec under take-off conditions, the air enters the engine from all four sides at relatively slow velocity; a dynamic pressure meter located 8 m in front of the air intake shows no positive reading; the pressure drop across the engine intake and exhaust is approximately 0.5 to 1 mm H<sub>2</sub>O; the air velocity over the outside engine wall is quite slow; there is insignificant "ground effect" on engine performance; in addition, there is no evidence of vortices or local turbulence in the entire flow field around the test stand.

The above observations indicate that the buildings around the outdoor test stand cause very little change in the flow field, and the ground effect and test stand effect are insignificant. The test stand, which includes the support frame and the pipes, also produces very little disturbance to the flow field.

#### Strength Test

The main structure of the test stand is designed to withstand 15 tons of forward thrust or 10 tons of forward thrust and 6 tons of reverse thrust, but the actual structure has certain margin over the specified values. The test results of various indices are shown in Tables 1-3.

Table 1. Results of Stress Test

Stress parameter	Transfer frame	Moving frame	Fixed frame	Leaf spring
Measured stress when forward thrust is 15 tons (kg/cm <sup>2</sup> )	313	340	100	933
Allowable stress (kg/cm <sup>2</sup> )	500-600			1600-1700

Table 2. Results of Vibration Test

Vibration parameter	Fixed frame		Moving frame	
	Horizontal	Vertical	Horizontal	Vertical
Maximum amplitude (mm)	0.011	0.0074	0.042	0.011
Maximum acceleration (g)	0.528	0.28	1.1	0.37

Table 3. Resonance Frequency Test

Direction of vibration	Fixed frame	Moving frame
Horizontal	18	3.0
Vertical	22	5.85

### The Test System

The main test instruments of the outdoor test facility have been certified by the Measurement Bureau. During certification tests all systems showed good reliability and repeatability; all instruments and sensors are subject to periodic recertification by the measurement units of the national defense system. Actual measurements show that the precision of instruments used in the test facility met the requirements of turbojet and turbofan engine specifications.

To account for differences in the load paths between calibration and operation conditions which will cause large "discrepancy in dynamic and static displacement" of the leaf spring, the counterbalance correction device is replaced by the hydraulic correction device in the thrust measurement system. For example, the "discrepancy in dynamic and static displacement" of the JT3D-7 P670806 engine under takeoff conditions was reduced from 0.5 mm to 0.079 mm.

In addition, synchronized automatic recording and printing devices are used in collecting data on key performance parameters such as thrust, fuel consumption, rpm, and exhaust temperature.

### Certification Test

The JT3D-7 P670806 engine was used as a test engine for certification of the test stand.

The engine was approved for production by the Pratt & Whitney (PWA) Co. on 21 November 1973 after certification tests conducted on the 67# test platform; the test records include a complete set of measured parameters and momentum-corrected thrust values.

The data from the two recent certification tests have been processed using the method of regression and compared with the original test data (see Table 4).

Table 4.

State	Test facility	EPR	$\left[\frac{F_n}{\delta_{t_2}}\right]_{\text{cor}}$ (kg)	$\Delta\left[\frac{F_n}{\delta_{t_2}}\right]$ (kg)	$\frac{N_1}{\sqrt{\theta_{t_2}}}$ (rpm)	$\frac{N_2}{\sqrt{\theta_{t_2}}}$ (rpm)	$\frac{T_{t_7}}{\theta_{t_2}}$ (°C)	$\frac{W_t}{\delta_{t_2} \sqrt{\theta_{t_2}}}$ (kg/hr)
Takeoff	PWA-67#	1.8665	8618	573	6380	9842	496	4575
	SBT		8545		6446	9899	512	4623
Maximum continuous flight	PWA-67#	1.7403	7802	540	6113	9642	464	4006
	SBT		7748		6190	9721	477	4065
Maximum cruise flight	PWA-67#	1.6330	7031	503	5885	9481	441	3527
	SBT		6985		5958	9553	447	3583

Note: The atmospheric conditions during tests were: at PWA-67#,  $P_0 = 768.9$  mm Hg,  $T_0 = 8.3^\circ\text{C}$ ; at SBT,  $P_0 = 763.5$  mm Hg,  $T_0 = 22^\circ\text{C}$

It is seen that the two sets of data do not differ a great deal. For example, the scaled thrust values after correction differ by 73 kg (relative difference is 0.85 percent) under takeoff conditions. This does not take into account temperature correction, humidity correction, corrections in thrust transmission parameters or differences in the test assembly.

Furthermore, the certification test data indicated that the test stand and all the measurement systems performed well in terms of stability and repeatability. For example, during the second certification test, the standard deviation of the measured thrust was only 9.7 kg.

Table 4 shows a comparison of the major performance parameters of the JT3D-7 P670806 engine between the Shanghai outdoor test facility (SBT) and the PWA-67#.

3012/9365

CSO: 4008/20



APPLIED SCIENCES

APPLICATIONS OF HIRFL HEAVY ION ACCELERATOR SURVEYED

Baoding WULI TONGBAO in Chinese No 4, 10 Aug 85 pp 23-28

[Article by Wu Guohua [0702 0948 5478] of the Modern Physics Institute, Chinese Academy of Sciences: "A Survey of HIRFL Heavy Ion Accelerator and its Applications"]

[Text] Heavy ions refer to all the ionized atoms in the periodic table that are heavier than helium. Heavy ion physics is an interdisciplinary science built on the applications of high-speed heavy ions. It has developed rapidly in the last decade and become a frontier field in physics.

China had a late start in the research of heavy ion physics, partly due to the lack of a suitable accelerator. In 1970 the Modern Physics Institute converted an ordinary 1.5m light particle accelerator into a heavy ion accelerator. A series of nuclear physics and nuclear chemistry studies using accelerated carbon, nitrogen and oxygen has led to encouraging results and filled the void in this area. However, this 1950 vintage accelerator is far from adequate. In 1973 we submitted a proposal for the construction of a new accelerator, an evaluation meeting was held in 1974, and in November 1976, the State officially granted the permission to build a heavy ion accelerator in Lanzhou.

Today, the earth work construction has been essentially completed and components are being fabricated and tested for an opening date in 1988. This accelerator will provide the research and application of heavy ion physics with an advanced facility and will become China's own heavy ion physics research center.

I. The HIRFL Heavy Ion Accelerator

The accelerator at HIRFL (The Heavy Ion Research Facility of Lanzhou) is a two-stage accelerator consisting of a main accelerator and an injection assembly, see attached figure. The main accelerator is a sector synchronous cyclotron (SSC) with an energy constant\* of  $K = 45$ . The main components are four  $52^\circ$

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\* The energy per nucleon of an accelerated ion is equal to  $K(Z/A)^2$  where  $K = 48(BR)^2$  is the energy constant,  $R$  is the radius of the final orbit and  $B$  is the magnetic induction.

straight edge sector magnets. Each magnet weighs 500 tons and is 5.3m tall. The maximum outer diameter is 6m, the inner diameter is 0.47m, and the pole face radius is 3.75m. The SSC also has two half wavelength accelerating cavities, an integrated vacuum chamber, five injection components, six ejection components and a number of beam diagnostic devices. The total weight is about 2200 tons.

The injector is a three sector focused cyclotron (SFC) with an energy constant of  $K=69$ . In order to reduce the cost, the SFC with a 1.7m diameter magnet is modified from a traditional Y-150 cyclotron with a 1.5m magnet. Table 1 shows the necessary modifications. As can be seen, the conversion involves considerable work.

Table 1. The injector before and after the modifications

	Y-150	SEC-170
Magnet	1.5 dia., flat pole face	1.7m dia., with added sector and compensation coil
Acceleration Chamber	Double cavity, double D	Single cavity, single D
Ion source	Radial	Radial, axial
Vacuum space Volume	4 m <sup>3</sup>	13 m <sup>3</sup>
Vacuum	$2 \times 10^{-5}$ torr	$5 \times 10^{-6}$ torr
Stability of excitation current	$2 \times 10^{-4}$	$1 \times 10^{-5}$

The beam transport system is about 60m long and consists of 34 magnetic lenses, 6 deflection magnets, 2 beam focusing devices and a stripper. Working together, these components efficiently transport the beam accelerated by the SFC to the input of the SSC. The injection and ejection systems effectively lead the beam into and out of the SSC and the beam distribution system diverts the beam to various experimental terminals.

The overall layout of the acceleration system is shown in Figure 1. The main accelerator SSC is capable of accelerating uranium to 10 MeV per nucleon but the SFC injector has yet to provide an ion beam heavier than xenon. As it stands the accelerator can accelerate all heavy ions lighter than <sup>132</sup>Xe. The parameters of several typical ion beams are shown in Table 2.



Table 2. Typical ion beam parameters

Parameter	Unit	$^{12}\text{C}$	$^{14}\text{N}$	$^{40}\text{Ar}$	$^{132}\text{Xe}$
Energy E	MeV/nucleon	7.58	8.45	4.19	0.46
Dispersion $\frac{\Delta E}{E}$	$\times 10^{-3}$	$\pm 2$	$\pm 2$	$\pm 2$	$\pm 2$
SFC Emissivity $\epsilon$	$\pi \text{ mm.mrad}$	12	12	12	12
Magnetic field B	KG	13.9	15.75	15.80	15.75
Charge Z		4+	5+	10+	11+
E	MeV/Nucleon	88	100	46	4.8
$\frac{\Delta E}{E}$	$\times 10^{-3}$	$\pm 3$	$\pm 2$	$\pm 2$	$\pm 3$
SSC $\epsilon$	$\pi \text{ mm.mrad}$	4	4	4	4
B	KG	14.44	15.44	12.91	9.47
Z		6+	7+	16+	23+

The Lanzhou facility will be a world-class heavy ion accelerator system. Table 3 shows a comparison of several representative foreign heavy ion accelerators and the HIRFL.

The experimental hall is 56m long and 26m wide, with 18 beams and 21 experiment terminals. The hall is divided into 11 experimental zones with dismountable shielding walls. The beam comes out of the accelerator hall, travels along the "fish spine" [herring bone] main line, and is distributed to the various experiment zones and terminals. The beam is brought out of the accelerator mainly by the SSC and the beams from the SFC may also be injected directly into the "fish spine". The front section of the main line is equipped with a " $\Omega$ " shaped beam processing system. To meet the experimental requirements, the processing system provides achromatic propagation, double dispersion propagation or dispersionless propagation. To optimize the beam propagation parameters, a number of diagnostic equipments will be installed along the transmission line, including beam scanner, multiwire chamber, Faraday pail, emissivity detector and slits.

## II. Basic Research Applications of HIRFL in Heavy Ion Physics

In his comment on the prospects of nuclear physics, the famous theorist A. Bohr has said that heavy ion physics will be the main stream of nuclear physics in

the next 10 years. We shall now elaborate on the implications: (1) The heavy ion beam allows the study of many nuclei unavailable before and many very short-lived nuclear systems. (2) Using heavy ion beams, new nuclear reaction mechanisms such as deep inelastic scattering are discovered. Experimental and theoretical studies of such new phenomena have become the most active research topics. (3) New state of motion has been discovered with the aid of heavy ion beam. The heavy ion reaction raised the study of nuclear motion to the realm of higher excitation energy, higher angular momentum and large deformation, resulting in the discovery of the turn-around phenomenon of the high spin state, the nuclear molecular state, and the configuration isomeric state. These studies are improving our understanding of the nuclear structure. (4) Heavy ion beam led to a number of new nuclides. All the super-uranium elements with an atomic number of 93 to 107 are synthesized with heavy ion reaction. In August 1982, the 109th element was synthesized at the GSI facility in West Germany by bombarding Bi with Fe. In addition, a number of nuclides far away from the  $\beta$  stability line were synthesized. (5) Using the heavy ion nuclear reaction, one may also study the phenomena associated with the strongest known electric field in the universe. The electric field in the collision of heavy ions is stronger than any known electric field in nature. This provides a unique way for checking quantum electrodynamics and for the study of nonlinear effects that take place only in extremely strong electric fields.

In the space above, we have only briefly described some of the fundamental physics problems related to heavy ions, and it is already clear that heavy ion research plays an important and promising role in the field of modern physics.

Five research projects on nuclear structure and nuclear reaction will be conducted at the HIRFL facility:

(1) The study of the nuclear surface structure

The surface structure of nuclei will be investigated in the observation of the surface changes and interactions when two nuclei approach each other. Specific research topics include elastic scattering and inelastic scattering of heavy ions, single nucleon transfer, double nucleon transfer, and collective transfer.

(2) The study of heavy ion reaction mechanism

Topics include the measurement of the excitation function, the formation and decay of highly excited nucleus, time of flight spectroscopy, excimer state and cross-section fluctuation, and angular distribution and angular correlation.

(3) Synthesis of new nuclides

Synthetic methods for new nuclides and their decay properties will be studied. It is estimated that about 2000 new nuclides may be synthesized on the heavy ion accelerator, including nuclides far away from the  $\beta$  stability line and superheavy nuclides.

#### (4) The study of high angular momentum state

This research will be on the properties of nuclei at a high rotational speed. The principal technique used in this study will be the decay of composite nucleus cascade neutron and cascade  $\gamma$ , and Coulomb excitation. In the measurement of cascade  $\gamma$  photon with multiprobe  $\gamma$  detector, ten probes are sometimes used for coincidence counting.

#### (5) The study of the macroscopic elasticity of nuclear matter

When a nucleus experiences a large impact, will the interior develop shock wave oscillations in nuclear density? In the collision of heavy ions, can nuclei of anomalously high density (supernuclei) be formed? These are extremely interesting and exploratory research topics.

The HIRFL is designed according to the energy, ion species, and current intensity and quality required for the above research projects. Work has been in progress since 1983 on the planning of the heavy ion physics laboratory, the design of the experimental hall, and particularly the terminal facilities and the data acquisition and processing systems. Once the accelerator is built, no time will be wasted in starting the physics experiments and the applications research.

### III. Applications of Heavy Ion Beams

In the last decade, heavy ion accelerators in the world are mostly devoted to the fundamental studies of nuclear physics and atomic physics. Some exploratory heavy ion beam applications have also been initiated. These studies will provide new methods and techniques for practical applications. The HIRFL will be able to provide all the heavy ions lighter than Xe, the energy per nucleon will be 5-100 MeV, the beam intensity will be  $10^{12} - 10^{13}$  particles per second, the energy dispersion will be  $(2-4) \times 10^{-3}$  and the emissivity will be 4-12  $\pi$  mm.mrad. The facility will open up a whole new prospective in heavy ion applications.

In the space below we introduce some of the applied research that can be done at HIRFL.

#### (1) Hole punching with heavy ion beam

Nuclear microscreen is a new type of microscreen developed in the 1970's. It is a special kind of ultrafine filter fabricated by irradiating polymer films with heavy ion beam. The passage of the heavy ions causes a narrow radiation damage zone. The film is then preferentially etched with chemical. Since the etching speed is greater for the damage zone, smooth and uniform submicron holes are produced. The fabrication procedure is very simple. The number of holes corresponds to the number of irradiating particles, the film thickness corresponds to the range of the heavy ion, and the diameter is controlled by the etching time. Microscreen filters with hole diameters of 0.01-10  $\mu$  m can now be made with heavy ion irradiated polycarbonic acid ester. A heavy ion accelerator

can produce a variety of monoenergetic, single isotope, highly parallel heavy ion beam with  $10^{10}$ - $10^{13}$  particles per second. The type of material and the thickness of the nuclear microscreen can then be broadened considerably. Work in this area has begun in the West Germany GSI and the France ALICE.

## (2) Fabrication of single orifice film

Single orifice film may be produced by bombarding  $20\text{ }\mu\text{m}$  thick, 30 mm diameter amorphous polycarbonic acid ester with  $4.8\text{ MeV/N }^{132}\text{Xe}$  ion beam. A collimator with a  $0.1\text{ mm}$  hole is placed in front of the film to block out any unwanted radiation. During the irradiation, the beam is stopped as soon as a detector behind the film detects a single particle. The irradiated film is then etched to produce the desired hole diameter ( $4\text{--}6\text{ }\mu\text{m}$ ). Such single orifice film may be used in the measurement of red blood cell deformation.

## (3) Surface property alteration

A superinsulation layer with a surface resistance of  $2 \times 10^{10}\text{ ohm}$  may be produced on the surface of mica by irradiating it with  $7.5\text{ MeV/N Xe}$  ion beam. At a dosage of  $10^7/\text{cm}^2$  the sample is chemically etched to produce an optimum hole spacing.

## (4) Radiation damage of metals

In 1967, operators of the (Tangli) fast [neutron] reactor in England discovered voids and swelling of the stainless cladding of the reactor core element. Since the structural material and cover material of the reactor are situated in a strong neutron flux and experience almost  $10^{15}$ - $10^{16}$  neutrons per second per square centimeter of the area. The material develops a high density of dislocation and, as a result, voids and swelling. It is therefore important to study the resistance to radiation damage of reactor material so that the proper material is selected in reactor applications. Simulation tests were conducted using the strong secondary neutrons,  $\gamma$  ray, and X-ray generated by high flux neutron generator, strong pulsed electron beam generator, and linear electron accelerator. In 1969 the British proposed to simulate neutron damage with heavy ions. But how can heavy ions simulate neutron damage? It turns out that the neutron damage is primarily caused by the recoiling atoms. Since the heavy ion has a large mass and charge, it is several thousand times more effective than neutrons in causing the atoms in the material to move away from their normal position. The radiation damage caused by a few hours of heavy ion irradiation is equivalent to several years in a high flux material test reactor. It is indeed a fast and economic way of studying radiation damage.

## (5) Solid state physics applications

Heavy ion beams can probe the material structural properties of a solid. For example, heavy ions may be used to sense the local magnetic field (hundreds of thousand to several million gauss) in ferromagnets and antiferromagnets. The hyperfine interaction of the heavy ion with the crystalline medium perturbs the angular correlation of the cascade transition process of the excited nucleus. This perturbation reveals the hyperfine structure of the material. This is known as the "perturbed angular correlation method". It can be used to study

liquids and gases as well, with a good sensitivity at any temperature. In the study of the magnetic field distribution in superconductor, the heavy ion perturbed angular correlation method is superior to nuclear magnetic resonance because the RF field used in NMR may cause a displacement of the magnetic flux in the superconductor whereas the injected heavy ion can realistically reveal the distribution of the static magnetic field in the superconductor. In addition, heavy ion probes may also provide useful information in metallurgy, such as the fine structure of alloys formed by different alloying techniques. It can also be used in the detection of lattice defects, impurity site distribution, and electromagnetic field in the lattice, and in the study of the nuclear spin polarization of magnetic materials. With a greater variety of heavy ion species and a higher energy, the range of application will be even greater and heavy ion beams will become even more useful in solid state physics.

#### (6) Beam-foil spectroscopy

When heavy ions of an energy 10 MeV/N pass through a thin film, ions lighter than tin will have all their electrons stripped off. For uranium ion, all the electrons except the inner most electrons are also stripped. This may be used in the study of the spectrum and lifetime of highly ionized atoms.

#### (7) Magnetic domain "pinning"

When some magneto-optic thin films are irradiated by heavy ions and then chemically processed, a microscopic grid of grooves may be etched on the surface, thereby stabilizing the "islands" of different magnetic orientation and "pinning" the magnetic domain. Such a method may increase the storage rate by a hundred fold and hence improve the optical storage and the calculation speed of integrated circuits.

Moreover, because the range of heavy ions is very constant in materials and the greatest energy transfer takes place at the end of the range, heavy ion beams have produced encouraging results in treating cancer. A heavy ion irradiation nuclear track technique may also produce a nonreflecting optical surface. When the interior structures of thick specimens are examined by heavy ion photography, the resolving power is good. As the number of heavy ion accelerators continues to increase and the research of heavy ion physics develops, more and more new applications will become possible. The HIRFL facility, schedule to come online in 1988, will surely provide superior experimental conditions for the study of heavy ion physics and its applications and open up a new research area in China.

9698/7051

CSO: 8111/2186



LIFE SCIENCES

SNAIL FEVER ERADICATED IN SHANGHAI, SAYS MAYOR

OW102220 Beijing XINHUA Domestic Service in Chinese 1421 GMT 10 Dec 85

[Article by reporter Zhou Jierong]

[Text] Shanghai, 10 Dec (XINHUA)--Snail fever has been eradicated in Shanghai, declared Jiang Zemin, deputy secretary of the Shanghai Municipal CPC Committee and mayor of Shanghai Municipality, at a meeting held in Shanghai today to celebrate the eradication of snail fever in the municipality.

Shanghai was one of the areas in the country seriously hit by the epidemic disease of snail fever. Since 1955, the municipality has gone all out to eradicate the disease. Over the past 3 decades, the state appropriated from the treasury special funds of some 40 million yuan to control snail fever in Shanghai. The municipality repeatedly mobilized the broad masses of people to eradicate snails in areas totalling some 1.5 billion square meters. Medical personnel dispatched by the municipal hospitals to rural areas treated some 1.8 million patients and performed operations to remove the spleens of 15,000 patients in the advanced stage of the disease. Some 13,000 septic tanks and 250 waterworks to provide clean well or tap water were built in areas hit by the disease.

Comprehensive and repeated checks on major epidemic areas in 159 towns and townships in the municipality by the first half of this year showed that snails had been eradicated and that 99.99 percent of the patients had been cured.

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CSO: 4008/1026

LIFE SCIENCES

PARASITIC DISEASE ELIMINATED IN GUANGXI REGION

OW072300 Beijing XINHUA in English 1302 GMT 7 Nov 85

[Text] Nanning, 7 Nov (XINHUA)--Filariasis, a parasitic disease common in South China, has been eliminated in the Guangxi Zhuang Autonomous Region.

The disease used to affect 14 Chinese provinces, autonomous regions, and municipalities. Guangxi is the third region, after Shandong and Guizhou, to have reduced the incidence of the disease to less than 1 percent of the population in the affected areas, the official definition of elimination.

A team of medical specialists sent to the province last month took blood samples from 43,408 people in 6 formerly heavily infected counties. These accounted for 91.5 percent of the local population.

Tests showed that only three people still had active larva of Filarial worms in their bodies.

Filariasis is a condition where the larva of a worm is found in the blood or lymph glands. The disease is carried by mosquitos and can cause elephantiasis, a gross enlargement of the limbs.

Guangxi Zhuang Autonomous Region was awarded 100,000 yuan by the Ministry of Public Health for eliminating filariasis, said Wang Jian, director of the Department of Epidemic Prevention of the Ministry of Public Health. In the past, more than 800,000 people in 68 counties and cities in Guangxi were infected by filariasis.

A mass mobilization to wipe out mosquitos has been launched every year since the 1950's. Meanwhile the majority of the patients have been treated.

Surveys of the disease have been regularly carried out. In epidemic counties, all inhabitants have been given a preventive medicine (a medicated salt) free of charge.

During the years between 1981 and 1984, the region emphasized prevention and treatment for the remaining affected areas.

/9365

CSO: 4010/1017

LIFE SCIENCES

NEI MONGGOL SUCCESSFULLY PREVENTS ENDEMIC DISEASES

SK190741 Hohhot Nei Monggol Regional Service in Mandarin 1100 GMT 18 Dec 85

[Text] During the Sixth 5-Year Plan period, our region has made greater progress in the prevention and treatment of endemic diseases. Over the past 5 years, in close cooperation with the regional department for prevention and treatment of local endemic disease and relevant departments, the region ceaselessly consolidated good results in which the region had not had a single case of human plague for 13 years in succession, basically controlled the occurrence of human brucellosis, and tended to stabilize sheep brucellosis. The incidence of acute and subacute Keshan diseases and the mortality of the people suffering from these diseases have dropped to the lowest level in history. So far, the region has basically ascertained the distribution of endemic goiter, endemic cretinism, fluorine poisoning, and the Kaschin-Beck disease; the number of people living in the disease-stricken areas, the number of people suffering from these diseases, and the content of elements leading to these diseases in potable water. Simultaneously the region has taken effective measures for preventing and treating these diseases. The prevention of fluorine poisoning and the improvement of water quality have been carried out among the fluorine poisoned areas. About 700,000 people in these areas are able to get water with standard fluorine content. Iodized salt has universally been applied by the people in the areas stricken by endemic goiter. Such measures as having child-bearing women and children take iodine pills have been taken to ensure the good health of women, children, and the unborn.

According to statistics from 1981 about 200,000 people suffering from endemic goiter have been cured every year. Thus, the incidence of endemic goiter has dropped by a large margin. So far, 46 banners and counties stricken by endemic goiter across the region have basically attained the requirements for disease control set forth by the central authorities.

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CSO: 4008/1026

LIFE SCIENCES

BRIEFS

SICHUAN BURNS-TREATMENT UNIT--Chongqing, 25 Oct (XINHUA)--An 11-story burns-treatment unit--the largest of its kind in China--has been completed in this city in Sichuan Province. The building, in the People's Liberation Army's No 3 Medical College, includes research facilities, a training center, laboratory operating rooms, and wards. The college has spent 3 million yuan on the unit, which has taken 2 years to build. It will specialize in research into respiratory tract burns, infections, wound dressing, and burn protection, said unit Director Li Ao. It is the only organization in China to do research on respiratory tract burns, he said. [Text] [Beijing XINHUA in English 1040 GMT 25 Oct 85 OW] /9365

WHITE BLOOD CELL TREATMENT--Xian, 30 Aug (XINHUA)--A device for reversing white blood cell decrease is on display at an exhibition of medical apparatus now being held in Xian, capital of Shaanxi Province. It raises the number of white blood cells by radiating patients with quantum light rays. It is painless and has no side-effects; the patients usually recover after about 10 days of treatment. Benzene poisoning is the main cause of white corpuscle decrease, and hitherto has been a severe treatment problem. About 340 patients have been cured by this new apparatus. The overall cure rate is 73 percent. The apparatus was invented by the Physical Medical Engineering Research group of Suzhou University, Jiangsu Province. [Text] [Beijing XINHUA in English 0640 GMT 30 Aug 85 OW] /9365

FROZEN HUMAN SEMEN--Changsha, 18 Nov (XINHUA)--Twenty-eight of 50 women who have voluntarily received frozen semen from China's first human semen bank have borne children or become pregnant. Experts noted here today that the 20 babies born by the women, who had received frozen semen at the human semen bank of the Hunan Medical College, were all healthy, intelligent, and lively. The oldest is 2 years and 9 months old. The human semen bank at the Hunan Medical College was set up in 1981. In January 1983, it produced China's first baby born after artificial insemination. [Text] [Beijing XINHUA in English 1835 GMT 18 Nov 85 OW] /9365

MENINGITIS CASES DROP IN HENAN--Beijing, Dec 6 (XINHUA)--The incidence of meningitis in Henan Province has dropped 75 percent, compared to last year, thanks to new preventive measures, according to the newspaper HEALTH NEWS. Deaths from the disease have decreased by 74 percent, according to the paper.

Henan has had a history of severe outbreaks of cerebrospinal meningitis, usually fatal to children, every 8 to 10 years, and experts had predicted that 1985-87 would see a new epidemic. The provincial government decided to vaccinate children under 15 years of age and adopt other preventive measures. Since December last year, 22 million children have been vaccinated, and, as a result, the incidence is 90 percent less than the estimated rate. [Text] [Beijing XINHUA in English 1508 GMT 6 Dec 85] /9365

ELIMINATION OF SNAIL FEVER--This morning the provincial government called a grand meeting at the provincial government auditorium to mark the 30th anniversary of Chairman Mao's directive on eliminating snail fever and to celebrate the elimination of snail fever in the province. Yang Yingbin, vice chairman of the provincial CPPCC Committee and chief of the provincial leading group for the prevention and treatment of endemic diseases, delivered an opening speech. On behalf of the provincial government, provincial Vice Governor Wang Pingshan made a summation of the work done by the province over the past 35 years in eliminating snail fever. (Gu Yingqi), Vice Minister of Public Health; (Luo Guang), head of the Central Leading Group in charge of snail fever prevention; Xie Fei, Deputy Secretary of the Provincial CPC Committee; and Luo Tian, chairman of the Provincial People's Congress Standing Committee, delivered speeches at the meeting. [Excerpts] [Guangzhou Guangdong Provincial Service in Mandarin 0400 GMT 9 Dec 85 HK] /9738

CSO: 4008/1026

## ENVIRONMENTAL QUALITY

### FOUR BILLION YUAN PER YEAR SPENT ON CLEANING UP ENVIRONMENT

HK160731 Hong Kong SOUTH CHINA MORNING POST in English 16 Dec 85 p 23

[Article by Julina Chan]

[Text] China is spending around four billion yuan (about HK\$10 billion) a year--almost 130 times that of Hong Kong--in cleaning up its environment.

Much of the emphasis is on two major goals: pollution control at rural factories and mass education on protection of the environment.

A senior Chinese environmentalist disclosed at a local conference that China's clean-up operation is in full swing in industrial cities. Pollution has reached "critical levels" in some cities.

There are plans for cooperation on air pollution control between three Chinese cities--Beijing, Shanghai, Guangzhou--and Hong Kong.

Speaking to the SCM POST [SOUTH CHINA MORNING POST] last week, the director of China's National Environmental Protection Agency, Mr Qu Geping, said China is probably taking the lead in Asia with about 44 universities offering more than 60 courses to 4,000 people on environmental protection.

And there are more than 100 research centers where more than 7,000 environmentalists are working on the problem.

Mr Qu led a delegation of Chinese environmentalists to Hong Kong to attend the Polmet [expansion unknown] '85 conference on environmental control earlier this month.

The delegation visited local environmental protection establishments, such as the Shatin sewage treatment plant, and met local EPA [Environmental Protection Agency] officials during their 10-day stay.

Mr Qu told the SCM POST that Hong Kong and China--as well as major cities in the world--faced the common problem of pollution, albeit in varying degrees.

He thought Hong Kong's pollution problems were, in general, "not very serious."

However, he said the territory should be alert to a worsening of the problem.

He said China's booming rural industries, which made a net annual profit of about 170 billion yuan (HK\$425 billion) posed a potential threat as the nation's newest source of pollution.

In a speech delivered earlier at the Polmet conference, Mr Qu said China has more than six million small factories in 200 towns.

In China, an urban area with a population of fewer than 100,000 people is classified as a town. The towns combined have more than 50 million workers.

Mr Qu said: China is making her seventh five-year plan for the national economy and social development, and environmental protection in cities is one of the major contents of this plan."

Commenting on his visit to the territory, Mr Qu said he was impressed by some Hong Kong manufacturers who had designed their own pollution control devices which were cheap and efficient.

He emphasized China was a developing nation and could not afford to buy very expensive equipment from Western countries. It made most of its pollution control equipment itself.

Mr Qu said the seriousness of pollution problems had prompted the Chinese Government recently to intensify efforts and take concrete measures to prevent the situation from deteriorating.

An environmental protection committee chaired by Vice-premier Li Peng was set up in May last year to enforce pollution controls. The committee has more than 20 directors or vice-directors from different Chinese departments covering agriculture, industry, transport--and even the military.

Mr Qu said the Chinese Government is also trying to make the public more aware of environmental protection. A newspaper, the CHINA ENVIRONMENTAL NEWS, was launched early last year. It now has a circulation of 500,000 and is expected to reach 700,000 copies next year, he said.

Earlier, the Commissioner of the EPA, Dr Stuart Reed, said China may consider trying some Hong Kong techniques on controlling noise pollution. He also said there is a possibility of collaboration with United Nations' organizations in studies of the level of motor vehicle emissions in Chinese cities and in Hong Kong. Dr Stuart said the cooperation between China and Hong Kong will include the exchange of experiences and some very detailed reports.

Meanwhile, a Health and Welfare Branch spokesman said the Government is spending about \$75 million a year on environmental protection. The figure excludes expenditure incurred by the Urban Services Department in its operations. In the past five years, the Government has spent about \$1.5 billion in capital expenditure on environmental protection. It plans to spend about \$2.4 billion in the next five years, the spokesman said.

## ENVIRONMENTAL QUALITY

### HEILONGJIANG PROVINCIAL ENVIRONMENTAL PROTECTION MEETING OPENS

SK170401 Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 16  
Dec 85

[Text] The Fourth Provincial Environmental Protection Meeting opened in Harbin on 16 December. At the meeting it was put forward that the general guidelines of the province's environmental protection work during the Seventh 5-Year Plan period should be: Focusing the work on cities and towns, and persisting in reform and comprehensively tackling problems in order to simultaneously plan, carry out, and develop economic construction, urban and rural construction, and environmental construction, and to achieve unity of economic and social returns as well as environmental effects.

In his speech to the meeting, Sun Weiben, secretary of the Provincial CPC Committee, pointed out: The key to making environmental protection work successful lies in the leaders' great attention and full understanding. As far as a leading cadre is concerned, whether he has exerted efforts to grasp environmental protection work is not only an issue concerning his workstyle but also one concerning his party spirit and competence. A successful environmental protection work depends on the party nature and the superiority of the socialist system. It is also the greatest economic and social returns which cannot be expressed by figures.

Hou Jie, deputy secretary of the provincial CPC Committee and governor, also spoke at the meeting. He called on the governments at all levels to strengthen leadership over environmental protection work, and strive to create a good environment for the people's production and livelihood.

An Zhendong, chairman of the Provincial Environmental Protection Committee and vice governor, put forward four measures for achieving the planned target of the province's environmental protection work during the Seventh 5-Year Plan period.

1. We should make continued efforts to solve the problems concerning the understanding of environmental protection and conscientiously grasp this work [word indistinct] the important tasks in the course of building the spiritual civilization.



2. We should prominently grasp the work of comprehensively tackling city environmental problems in order to simultaneously plan and carry out urban construction as well as environmental construction, to simultaneously grasp production, the people's livelihood, the environment protection work, and to control and stop new pollution.

3. We should improve the environmental protection organs, and use economic, administrative, and legal means to strengthen management over environmental work.

4. We should strengthen the leadership of the governments at all levels over environmental work, work out environmental protection plans, establish the responsibility system in environmental protection work, and raise our province's environmental protection work to a new level.

/9738

CSO: 4008/1027

ENVIRONMENTAL QUALITY

ANAEROBIC BIOLOGICAL TREATMENT OF WASTEWATER CONTAINING TNT, RDX

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese  
Vol 5 No 5, 21 Oct 85 pp 2-7

[Article by Xue Yuxiang [5641 3768 7449] and Jin Jianyong [7246 1696 3057],  
Design Institute No 6 of the Ministry of Ordnance Industry]

[Text] TNT (2,4,6-trinitro-toluene), RDX (hexahydro-1,3,5,-trinitro-1,3,5-triazine), and a mixture of both are generally used powder charges in the ammunition-loading plants in China. TNT is toxic and causes liver damage (hepatitis), aplastic anemia, and, in some cases, death. When inhaled in small quantities over extended periods, RDX dust causes symptoms of slow poisoning such as headaches, digestive disorders, and frequent urinating. If a large quantity of RDX enters the body through either inhalation in a short period of time or the digestive tract, acute poisoning symptoms occur, which include headaches, dizziness, nausea, weakness, seizures of the limbs, head, and neck, and, in serious cases, unconsciousness, face and extremities turning blue, convulsions, and tongue-biting. (Footnote 1) (Sun Rongkang, et al., "The Chemistry and Technology of High Explosives," Vol 1, 1981, p 247) In the process of powder charge production, wastewater containing TNT, RDX, or a TNT-RDX mixture are discharged into the water system and can cause damage to aquatic life. By being released into the environment, they directly threaten the health of animals, plants, and human beings. Therefore, the treatment of loading-plant wastewater containing TNT and RDX has become a current issue that urgently needs to be solved.

The microbiological treatment of wastewater containing TNT was first studied abroad in the 1940's. But it was found that TNT was very resistant to degradation by microorganisms. The study of TNT-transforming microorganisms by Osmen and Won in the early 1970's induced investigators both at home and abroad to undertake further research and steady advancements have been made. (Footnote 2) (Zhou Peijin and Chen Huarong, HUANJING KEXUE XUEBAO [JOURNAL OF ENVIRONMENTAL SCIENCES], Vol 1 No 3, 1981, pp 259-265) TNT is now regarded as easily biodegradable but it is generally held among experts that RDX is quite inert to biodegradation. The biological treatment of the wastewater containing the TNT-RDX mixture is still an unsolved problem in China. No information or patent report pertaining to this subject has been found abroad after searching the patent literature of the United States (1971-83) through a computer terminal.

In this article, the anaerobic biological treatment of wastewater containing TNT, RDX, or a TNT-RDX mixture has been tested through small-scale and production-scale trials with good results that meet the anticipated goals. After treatment, the TNT and RDX content of water and the major indicators such as COD and BOD all fall within the national discharge standards. At present, it has been formally put into operation and applied to the treatment of loading-plant wastewater containing a mixture of TNT and DNN (dinitronaphthalene).

## I. Experimental Methods

### A. Sources of Wastewater

For small-scale static and dynamic experiments, wastewater was prepared by dissolving industrial-grade TNT and RDX in tap water to make TNT, RDX, and mixed TNT-RDX solutions of different concentrations according to the experiment's requirements. Wastewater used for the production-scale trials was the discharge from floor washings, equipment and container cleaning, and water bath dust removers of the loading-plant workshops. Besides TNT and RDX, the wastewater also contained a small amount of sand and grease. Generally, the concentration of TNT was 7-41 mg/l and RDX 8-40 mg/l.

### B. Collection and Conditioning of Anaerobic Sludge

The sludge from the water pond of slaughterhouses was collected for small-scale static and dynamic experiments. The sludge from the bottom of fishponds was used for production-scale trials. The collected sludge was placed in a conditioning pond and wastewater containing TNT, RDX, and ample nutrients that bacteria can utilize was added. At the initial stage of conditioning, the concentrations of TNT and RDX should be kept low and gradually increased. During conditioning, the water was replaced every 3-4 days. Normally, it is ready for use after a month of conditioning.

### C. Apparatus

The small-scale static experiments were carried out in the lab by using 500-ml anaerobic digestion bottles.

The device for small-scale dynamic experiments was an upflow anaerobic sludge reactor made of plexiglass. It was 140 mm in diameter and 2 meters high with a total volume of 30 liters. The internal structure consisted of an inflow port at the bottom, on top of which was an anaerobic sludge bed with the strong degradability of TNT and RDX, and a middle section with no loading so that the sludge floated and resettled in this region. At the top were the charcoal and gas-liquid separation layers. Wastewater entered from the bottom of the reactor and exited at the top after anaerobic biological treatment.

Production-scale trials were carried out in a plant. The treatment device was an upflow anaerobic sludge reaction tower, which was made of steel plates. It was 2 meters in diameter and 6.7 meters high with a total volume

of 14.4 cubic meters and a net water capacity of 9.6 cubic meters. It treated wastewater at a rate of 1-2 cubic meters per hour. The internal structure is similar to that of the reactor for small-scale dynamic experiments. The process for production-scale trials is shown in Figure 1. The wastewater from workshops entered the reservoir and then was pumped directly into the reaction tower, where the anaerobic biological treatment was carried out. The water coming out of the tower was released after aeration for spontaneous oxidation.

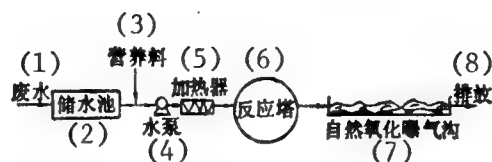


Figure 1. Illustration of the Process for Production-Scale Trials

#### Key:

- |                   |   |
|-------------------|---|
| 1. Wastewater     | 5. Heating element                          |
| 2. Reservoir      | 6. Reaction tower                           |
| 3. Nutrient feeds | 7. Aeration ditch for spontaneous oxidation |
| 4. Water pump     | 8. Discharge                                |

#### D. Analysis Methods

TNT was determined by NaOH-ethanol colorimetry.

RDX in the untreated water was determined by colorimetry using an acid indicator. For treated water, it was extracted with benzene and determined by oscillographic polarography.

COD was determined by the conventional potassium dichromate method.

BOD was determined by conventional analysis.

## II. Results

### A. Experimental Conditions

1. Nutrient: Any nutrient with an appropriate carbon/nitrogen ratio can be used. For example, the soaking water of dried sweet potatoes or husked rice, rice-washing water, and flour all can substitute for beef extract, yeast extract, and glucose as good nutrients for bacteria. Among them, flour is a more desirable nutrient for the anaerobic biological treatment because it is easily attainable, inexpensive, and easy to use and has no delivery problem.

2. Temperature: The upflow anaerobic sludge reactor was used to study the effect of temperature on TNT and RDX treatment. The water pumping rate was

1 liter per hour. Wastewater was retained in the reactor for 19.5 hours. The results are shown in Table 1.

Table 1. Temperature Effect on the Removal of TNT and RDX

Temperature (°C)	Concentration in inflow (mg/l)		Concentration in effluent (mg/l)		Removal rate (percent)	
	TNT	RDX	TNT	RDX	TNT	RDX
18-20	50	40	0.38	10.47	99.24	73.82
21-23	50	40	0.94	7.77	98.12	80.58
25-30	50	40	0.13	0.40	99.74	99.00

Note: Data shown are average values

It can be seen from Table 1 that over 99 percent of the TNT and RDX are removed at the treatment temperature of 25-30°C. When the temperature drops to 18-20°C, the removal rate of the RDX drops to 73.82 percent although that of the TNT remains over 99 percent. Therefore, under the conditions of this experiment, the optimal temperature for the anaerobic biological treatment of the mixed TNT-RDX wastewater is 28±3°C. For the pure TNT wastewater, better results can be obtained by maintaining the temperature at 20±2°C. In the production-scale trials, good results were obtained for the treatment of TNT and RDX by maintaining the temperature of the reaction tower between 25-35°C.

3. Sludge concentration: The sludge concentration experiments were carried out in anaerobic-digestion bottles. In order to determine the optimal sludge concentration, the TNT wastewater of various concentrations was treated with sludge of different concentrations. The results are shown in Table 2.

Table 2. Relationship of TNT Removal Rate With Sludge Concentration

Sludge concentration (vol percent)	TNT content in inflow		
	20(mg/l)	60(mg/l)	100(mg/l)
	Average removal rate (percent)		
5	75.75	64.25	34.20
10	81.75	73.35	45.05
20	94.68	83.09	63.20
30	98.48	88.30	75.20
40	96.18	89.08	78.72
50	98.60	93.00	88.23
60	98.48	96.25	86.22

Notes: 1. Sludge concentrations were calculated as volume percentage (vol percent).  
 2. 3 hours at 37°C.  
 3. Equivalent volume of inflow containing some amount of TNT was used.  
 4. Data shown are average values.

It is clear from Table 2 that, being very efficient, the removal rate of the TNT increases linearly in the sludge concentration range of 5-30 percent. A further increase in sludge concentration creates a slow increase in the removal rate. At 60 percent of sludge concentration, the amount of sludge is doubled when compared with 30 percent, but the removal rate of the TNT is only increased by 10 percent. Therefore, the optimal concentration is 20-30 percent (volume percent).

## B. Results of Small-scale Static Experiments

### 1. Removal of TNT

The TNT concentrations in the inflow were 20, 40, 74, 108.8, 130.6, and 148 mg/l; pH was 6.4-6.7; the temperature was 37°C; and the sludge concentration was 20 volume percent. The time dependence of TNT removal was studied and the results are shown in Table 3.

Table 3. Time Dependence of TNT Removal

TNT content in inflow (mg/l)	Treatment results (average values)			
	2 (hr)	6.5 (hr)	10 (hr)	12 (hr)
20	77.80	94.90	96.40	96.90
40	65.50	94.95	99.35	99.80
74	55.40	85.14	99.10	98.44
108.8	54.05	77.03	92.65	96.88
130.6	50.25	73.21	93.11	97.55
148	54.06	76.36	89.19	95.14

It can be concluded from Table 3 that: 1) with time constant, the lower the TNT concentration, the higher the removal rate; 2) with TNT concentration between 20-74 mg/l, the removal rates before 6.5 hours differ significantly and approach a constant beyond this time point. The removal rate is basically constant after 10-12 hours of treatment. When the concentration range increases to 108.8-148 mg/l, the removal rate remains steady regardless of time. It is surmised that bacteria produce induced enzymes readily at a low concentration of pollutants but the production is inhibited or even inactivated when the pollutant concentration is too high and results in a prolonged treatment period.

### 2. Removal of RDX

The RDX concentrations in the inflow were 10, 20, 30, and 40 mg/l. The temperature, pH, and sludge concentrations were the same in the TNT experiments. The results of the time dependence study of RDX removal are shown in Table 4.

From Table 4, it can be seen that the removal rate has a linear relationship with treatment time but has little correlation with the RDX concentration in the wastewater. Within a certain period of time, the removal rate fluctuates

very little. The time (t) dependence of the removal rate (Y) can be approximately represented by the following equation:

$$Y = 36.6t^{0.25}$$

3. The removal rates of the TNT and RDX in the mixed wastewater are shown in Table 5.

Table 5. Time Dependence of the Removal Rates of TNT and RDX

Content in influent (mg/l)		TNT removal rate (percent)				Content in influent (mg/l)		RDX removal rate (percent)			
TNT	RDX	2 (hr)	6 (hr)	10 (hr)	12 (hr)	TNT	RDX	12 (hr)	24 (hr)	35 (hr)	48 (hr)
52	20	58.15	92.54	--	99.62	52	20	45.20	69.55	75.00	86.00
104	40	50.24	76.67	91.72	95.70	104	40	--	66.83	77.76	85.83

Note: All data are average values

It can be concluded that: 1) within 12 hours, the TNT removal is nearly complete while the RDX removal, though slower, reaches 45 percent. 2) It is mainly the RDX that gets degraded during the 12-48 hours. It is believed that TNT degrades easily. RDX is a heterocyclic compound and its degradation takes a certain amount of time and goes through a certain process. 3) The removal of the RDX in the mixed TNT-RDX wastewater is not affected by its concentration in the inflow. The removal rates fluctuate very little with different time periods.

### C. Small-scale Dynamic Experiments

#### 1. Removal of RDX

The pH of the inflow was 6.4-6.7 and the treatment temperature was 28±3°C. The sludge concentration was 20 volume percent. The removal efficiency as opposed to the residence time in the reactor is shown in Table 6.

Table 6. RDX Removal Efficiency at Different Residence Time

Residence time (hr)	RDX content (mg/l)	Removal rate (percent)
0	22.58	0
1.5	6.50	71.21
7.5	5.90	73.87
12.5	4.60	79.67
15.5	4.05	82.06
19.0	4.00	82.29

It is clear from Table 6 that the removal rate of RDX quickly reaches 71.21 percent when the residence time in the sludge bed of the reactor is 1.5 hours. The removal rate ( $Y_1$ ) changes linearly with time ( $t$ ) and can be expressed by the equation below:

$$Y_1 = 100 - 19.2t$$

When the flow of wastewater continues on from the sludge bed to the outlet of the reactor, the total residence time inside the reactor is 7.5-19 hours. The removal rate ( $Y_2$ ) also changes linearly but moderately with time ( $t$ ) and can be expressed by the equation below:

$$Y_2 = 70.26 + 0.634t$$

It is clear that the sludge bed of the reactor removes RDX rapidly and there is a breaking point in the removal pattern, beyond which the removal rate changes only slightly and approaches a constant. This suggests that the removal of RDX is mainly due to the sludge bed.

## 2. Experimental Results of the Removal of TNT and RDX in the Mixed Wastewater Are Shown in Table 7.

Table 7. Removal Efficiency of TNT and RDX in the Mixed Wastewater at Different Residence Time

Residence time (hr)	TNT (mg/l)			RDX (mg/l)			Remarks
	Inflow	Efflu- ent	Removal rate (per- cent)	Inflow	Efflu- ent	Removal rate (per- cent)	
0.75	47.50	0.45	99.05	20.00	0.38	98.10	Effluent from sludge bed
1.50	42.50	0.30	99.29	22.14	3.25	85.32	Effluent from sludge bed
9.50	47.50	0.33	99.31	20.00	0.46	97.70	Effluent from reactor
19.00	42.50	0.18	99.58	22.14	0.19	99.14	Effluent from reactor

It can be seen from Table 7 that over 99 percent of the TNT is removed and the removal rate of RDX is over 85 percent when the mixed wastewater stays in the sludge bed for 0.75-1.5 hours. With a total residence time of 9.5-19 hours, the removal rate of the RDX also reaches over 97 percent so that the TNT and RDX in the effluent meet the discharge requirements.

## 3. Removal of BOD and COD

The COD and BOD values of the mixed TNT-RDX wastewater are very small. For 1 mg/l of TNT, the COD was determined to be 1.0-1.5 mg/l and the BOD 0.57 mg/l whereas for 1 mg/l of RDX, the COD determined was only 0.2 mg/l and the



BOD was undetected. Therefore, the COD and BOD in the inflow are mainly attributed to the flour added as nutrient feed. The COD value of the inflow is about 440 mg/l and the BOD 260 mg/l. After treatment, the COD is about 130 mg/l and the BOD 80 mg/l. The removal rate of the COD and BOD are 70 and 69 percent, respectively.

We also noted in the experiments that there was a better correlation between the COD and BOD in the effluent, namely  $COD = 1.5 BOD$ .

Therefore, for the anaerobic treatment of the mixed TNT-RDX wastewater, if not equipped to measure the BOD, its value can be roughly estimated from the COD value by using the above equation. Because the water quality affects the correlation between the COD and BOD, the above equation should not be applied to other cases.

#### IV. Results of Production-scale Trials

The production-scale trials were based on the parameters of the small-scale experiments. The source of waste was the mixed TNT-RDX wastewater released in the production process of loading workshops. The capacity of the reaction tower is 1.0-1.5 cubic meters per hour and the total residence time of the wastewater in the tower was 18.4-21.6 hours, in which 1.0-1.5 hours were the time in the sludge bed. The treatment temperature was 25-35°C. Flour was added as a substitute nutrient for bacteria and the added amount was 0.15-0.20 kg/l of wastewater (carbohydrate content was 150-200 mg/l). The pH of the inflow was 6.0-6.5. Judging from the operation results since November 1982, the treatment works remarkably.

##### 1. Removal of TNT and RDX

The average treatment results of the TNT and RDX in the production-scale trials are shown in Figures 2 and 3.

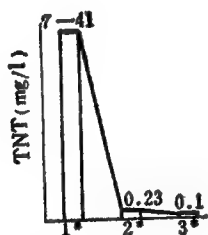


Figure 1. Concentration Change of TNT Before and After Treatment

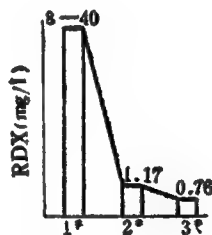


Figure 2. Concentration Change of RDX Before and After Treatment

1. Inflow
2. Effluent from sludge bed
3. Effluent from reaction tower

It can be seen from Figures 2 and 3 that the TNT and RDX are mainly removed by the sludge bed in the anaerobic sludge reaction tower. The effluent from the tower meets the discharge requirements for TNT and RDX. The acute toxicity tests were carried out for the effluent from the treatment by testing on carp and goldfish for 96 hours. All appeared normal and there were no deaths.

## 2. Removal of the COD and BOD

In the small-scale dynamic experiments, the COD and BOD values of the effluent were in excess of the discharge standards, mainly because the anaerobic biological process is a reducing one so that the effluent is rather reductive. In the production-scale trials, an aeration ditch for spontaneous oxidation was added. Through the spontaneous oxidation in the aeration ditch, the quality of the effluent was completely within the discharge requirements as shown in Figures 4 and 5.

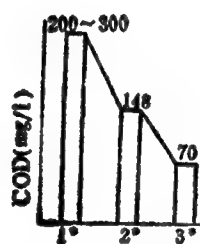


Figure 4. Change in COD Before and After Treatment

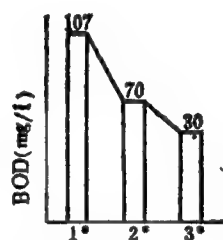


Figure 5. Change in BOD Before and After Treatment

1. Inflow
2. Effluent from reaction tower, not aerated
3. Effluent after aeration

## 3. Changes in Different Types of Nitrogen

In the production-scale trials, three types of nitrogen, namely  $\text{NO}_3^-$ -N,  $\text{NO}_2^-$ -N, and  $\text{NH}_3$ -N, as well as the total nitrogen content were determined. The results are shown in Figure 6.

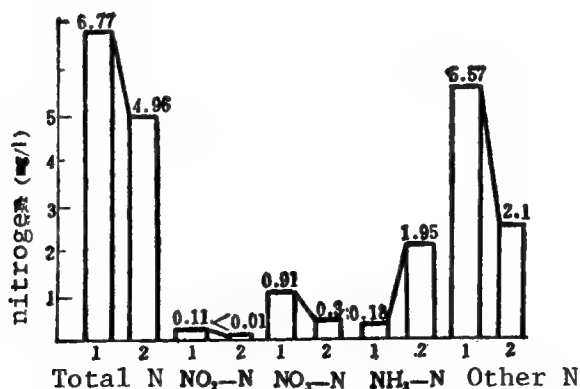


Figure 6. Changes in Different Types of Nitrogen  
1. Inflow 2. Effluent from reaction tower

From Figure 6, it can be seen that there are changes in the nitrogen content of the TNT and RDX after treatment. The decrease in total nitrogen and the increase in ammonia-type nitrogen indicate that the anaerobic biological process favors the production of inorganic material.

## V. Conclusions

The anaerobic biological treatment of TNT, RDX, and mixed TNT-RDX wastewater is very effective.

The technical process and treatment equipment are simple. The design of the reaction tower is very rational and its simple construction and small size result in a little space requirement and a low investment. It is easy to operate and manage. The anaerobic sludge can be maintained at room temperature under appropriate conditions for a long time and the treatment facility can be operated continuously or intermittently. It is also highly adaptable to changes in the composition of the powder charge used in ammunition plants.

The nutrient source is easily attainable. As substitute nutrients for microorganisms, flour, the soakings of dried sweet potatoes, and other materials have the appropriate carbon/nitrogen ratios, are inexpensive, and meet the requirements of the anaerobic biological treatment of the mixed TNT-RDX wastewater.

It is low in electricity and heat consumption, so its operating cost is low.

It has a high loading capacity. The TNT, RDX, and mixed TNT-RDX wastewater of different concentrations all pass the national discharge standards after treatment.

In the process of treatment, very little sludge is generated, hence there is no sludge after-treatment problem. Because of the good reactivity of the anaerobic sludge, there is no hardening or caking of the sludge in the reactor (reaction tower).

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## ENVIRONMENTAL QUALITY

### BRIEFS

**TIANJIN SEWAGE TREATMENT PLANT**--The Jizhuangzi Municipal Sewage Treatment Plant has made new achievements in scientific management and comprehensive utilization over the past six months. On approaching the neat plant area, people will find a newly built control tower 20 meters high, on which the new television system imported this October for operational control has been set up. From the screen of the television set the controller can clearly watch the operations of the generator room, water treatment room, and other rooms. The sewage treatment plant has also adopted the micro-computer system in operational management. On 26 October Ni Zhifu, Secretary of the Municipal CPC Committee, paid an inspection visit to the plant and acknowledged its achievement in applying new technology and modernizing its operations. He also encouraged the plant to further exert efforts to conduct comprehensive utilization and develop diversified economy. [Text] [Tianjin City Service in Mandarin 0030 GMT 7 Nov 85 SK] /9738

**MAYOR ADDRESSES SHANGHAI FORUM**--In addition to the water diversion project in the upper stream of the Huangpujiang and the Pudong Natural Gas Plant Pollution control project, Shanghai will fulfill six additional environmental protection tasks next year. This was disclosed at the municipal environmental protection conference, which opened on 6 December. Speaking at the forum, Mayor Jiang Zemin pointed out: The leadership at all levels should fully understand the necessity and urgency of protecting the environment through comprehensive measures. Environmental protection should develop along with economic growth in rural and urban areas from the planning stage. [Excerpts] [Shanghai City Service in Mandarin 2300 GMT 6 Dec 85 OW] /9738

**GOVERNOR ADDRESSES POLLUTION CONFERENCE**--The National Work Conference on the Survey of Industrial Pollutants was held in Nanchang this morning. Responsible persons of the environmental protection departments of the various ministries and commissions under the State Council, various provinces, municipalities, autonomous regions, the PLA, and environmental protection experts and engineers, a total of 170 people, attended the conference. The responsible persons of the environmental protection departments of the various prefectural administrative offices and cities directly under the jurisdiction of the provincial government attended as observers. The main tasks of the conference are to sum up and exchange views on the achievements scored and experiences

gained in the survey of industrial pollutants in the previous stage and to discuss and plan work in the next stage. (Xiao Tianhu), Deputy Director of the State Environmental Protection Bureau, presided over the conference. Ni Xiance, Deputy Secretary of the provincial CPC Committee and provincial governor, and responsible persons of departments concerned spoke at the conference. [Text] [Nanchang Jiangxi Provincial Service in Mandarin 1100 GMT 10 Dec 85 OW] /9738

WUHAN COMPANY FIGHTING POLLUTION--Wuhan, 10 Dec (XINHUA)--The monthly deposits of soot from the chimneys of the Wuhan Iron and Steel Company have fallen from 74 to 51 tons per sq km, according to Hou Jinfeng, Head of the company's environment protection office. From 1981 to 1985, the company, China's second largest, allocated 90 million yuan in environmental protection and trained 1,700 specialists in this field. With the money, four of the plant's five oxygen-blowing open hearth furnaces were fitted out with electric dust removers and a waste water treatment project was built for the coke plant. The company plans to pour 70 million yuan into pollution control in the next five years. The company, which has 100,000 workers, had no environmental protection facilities when it was built in the 1950s. [Text] [Beijing XINHUA in English 0709 GMT 10 Dec 85 OW] /9738

CSO: 4010/1021

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### RESEARCH INSTITUTE INITIATES TECHNOLOGY SHAREHOLDING

Beijing RENMIN RIBAO in Chinese 11 Oct 85 p 3

[Article by reporter Ruan Rongsen [7086 2837 2773]: "Try Out of Technology Shareholding To Integrate Research and Production"]

[Text] Institute No 9 of the Ministry of Electronics Industries has adopted the means of technology shareholding in the restructuring of the science and technology system, and has joined with enterprises in a new kind of relation. In less than 9 months time five scientific research projects were smoothly shifted to production areas. Those products have now come on the market, and both the institute and the enterprises have benefited from them. At the electronics industry science and technology working conference that concluded 26 September, representatives gave full affirmation to this method.

Institute No 9 of the Ministry of Electronics Industries is an organization that specializes in research into magnetic materials and devices. It is situated in Mianyang of Sichuan Province with a staff of over 1,100 and more than 460 specialists and technicians. Before the reform of the science and technology system, this institute had over the years finalized the design for or appraised the technology for 124 projects, 71 of which had received achievement awards from the National Science Association, the National Defense Construction Organization, the Ministry of Electronics Industries, and the Sichuan Provincial Science and Technology Conference. But only 20 of these projects were given over to factories to be put into production, only 16 percent of the total.

In August 1984 Institute No 9 was made an experimental unit by the Ministry of Electronics Industries in the restructuring of the science and technology system. They considered all sorts of ways to change the situation whereby scientific and technical achievements were "held in storage" in great numbers, and sought a path that would allow scientific and technical achievements to bring full results to society, to enterprises, and to research units. And on the basis of trying out compensation for the transfer of rights to technology, they also looked into the new method of technology shareholding.

There is a difference between technology shareholding and compensated transfer of rights to technology. The transfer of rights to technology sells technology on a one-time basis; but technology shareholding is where research units join in partnership with production units, and where the number of

shares of the research unit is figured by the value of the technology they put into operation. The research unit will assume the responsibility for the use of this technology over a long period, and for that time will share in the profits to the extent of the proportion of their shares, until the production unit is no longer using that technology.

Each time that Institute No 9 undertakes technology shareholding, they will send out technicians to take long term responsibility for use of the technology, and will manage in common the production that uses this technology. The institute can accept advice on this technology at any time, and at any time resolve problems that arise during the production process. The quality of the products will be checked with the participation of the institute, and they will jointly open marketing channels. During use, the institute has the responsibility to pay attention to the further development of the technology that is held in shares, as well as for training workers at the factory who will be using the technology. Administrative and residency matters for the technicians who are sent out will not change, and they can still take on one or two topics for study at the institute. Their benefits will generally be somewhat greater than that of the staff working at the institute, and after working outside the institute for a certain period of time they may become eligible for transfer.

In 1984 this institute transferred the rights of a microprocessor controlled precision temperature controller that it had designed in full to the Chengdu Municipal Electronic Instrument Plant for production, for an acknowledged share of stock of 30 percent according to its value. By the first half of 1985, 20 temperature controllers had been manufactured for a profit of more than 70,000 yuan, of which the institute was able to take more than 20,000. After the institute had priced a technology for improving the quality when using soft magnetic ferrite cores for television sets, it accepted a 25 percent of the value in shares from the Magnetic Materials Plant in Wuxi, Jiangsu, and also sent four technicians there, of whom one engineer was appointed to be a senior engineer at the plant. The technology from Institute No 9 allowed improvement of the acceptance rate for the soft magnetic ferrite of this plant from 5 percent to 85 percent, and it is estimated that the institute will receive 30,000 yuan this year from its shares. This institute has also accepted 25 percent in shares from the Magnetic Head Plant in Guanghan, Sichuan for a technology for the production of a vital component of color video recorders, a drum module on the video head, and an engineer sent by the institute to be responsible for the technology was hired as the factory director, and the factory sent 40 youths to the institute for training in this technology. The annual production of the drum module for the video head is planned to be 30,000, with an output value of 6 million yuan, of which the institute would get 25 percent of the profit.

The Magnetic Materials Plant of Zhuji, Zhejiang imported an entire set of production equipment from the United States for electric motor tile-shaped ferrite permanent magnets, but technical capabilities within the plant were insufficient, and Institute No 9 considered its assumption of the responsibility for dealing with the production technology of this equipment as worth 20 percent in shares, and also assumed a corresponding risk of 20 percent for the loan to import this equipment. The institute sent out an

engineering group to be stationed at the factory and be responsible for the technical work. After this equipment has been put into production, more than half of the products will be resold abroad, with an estimated annual output value of up to 15 million yuan, of which the institute will share in 20 percent of the profits.

When Institute No 9 first began trying out technology shareholding, some people could not understand it, saying that the institute should not be tied to enterprises for long periods, that it was better to "take a shot and then change places," otherwise we would get involved and might be unable to get out; others felt that turning over technology to other people would be letting others take advantage of us; still others felt that to assume the long term responsibility for the use of a technology would disperse the energies of institute personnel, and would affect the research task of the institute.

Practice has answered the doubts of some comrades. The research achievements transferred to factories for production in the first 9 months of this year have been twice the yearly average in the past for transferring and putting achievements into production. Production tasking completed in the first half of this year is 1.1 times that of the entire last year. The advantages to technology shareholding have already become apparent. First of all, it has allowed research units and production units to establish long term, stable cooperative relations, there is mutual benefit, there are shared risks, and profits are enjoyed jointly. Because the Institute can assume total responsibility for the technology, the production units can buy technology without worry, while with one-time transfer of technology rights production units will at times have too many worries and will not know whether the technology can be effective, nor do they know what problems might lie ahead. Also, technology shareholding has changed the tendencies in which institutes cared only for research and neglected application, and it has caused scientists to pay attention in their work to solving the problems in the transition to production of technology, techniques, and equipment, which is beneficial for the integration of research with production. In the past, Institute No 9 had mainly done research in military projects, products developed by the institute were few, no consideration was given to costs, they were accustomed to their "ordinary style of living," and had no experience with large scale production. Now, technology shareholding has pressured them into considering the various problems of large scale production in the manufacturing process, it has also provided advantageous conditions for scientists to go to the first line of production and understand and study large scale production technology, and it has stimulated the institute to change from a pure scientific research model to one of a scientific operation. Third, technology shareholding has aroused the enthusiasm of scientists, and has opened up vast areas for their various talents. There is an engineer at the institute who on the one hand took on the responsibility for using the technology at the Zhuji County Magnetic Materials Plant, while on the other hand continuing research on "magnetic liquids." He took care of both jobs, each of which benefited the other. In this way, scientists will be satisfactorily occupied, and the research potential will be fully exploited.

12586

CSO: 4008/1011



SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

BRIEFS

SHANGHAI MAYOR ATTENDS MICROCOMPUTER MEETING--The Shanghai Municipal Association for Microcomputer Application held its second academic meeting at Jiaotong University yesterday. Jiang Zemin, mayor of Shanghai and honorary chairman of the association, expressed his views at the meeting on how to popularize the use of microcomputers. More than 1,000 scientists and technicians in Shanghai who use microcomputers attended the meeting. More than 100 academic papers were presented at the meeting. [Excerpts] [Shanghai JIEFANG RIBAO in Chinese 25 Nov 85 p 2] /9365

SCIENCE, TECHNOLOGY ASSOCIATION--Beijing, 30 Nov (XINHUA)--The China Association for Science and Technology reorganized its secretariat at a recent standing committee meeting. Gao Zhenning, Gao Chao, and Chen Shenqwu, Li Baoheng, Cao Lingzhong, and Chen Hong now serve as members of the Secretariat. [Summary] [Beijing XINHUA Domestic Service in Chinese 0812 GMT 20 Nov 85 OW] /9365

CSO: 4008/1025

PUBLICATIONS

MORE ON CHINA SCIENCE AND TECHNOLOGY NEWS

HK110753 Beijing GUANGMING RIBAO in Chinese 1 Nov 85 p 1

[Report by Hai Ning [3189 1337]: "ZHONGGUO KEJI BAO [CHINA SCIENCE AND TECHNOLOGY NEWS] To Be Published on New Year's Day; Deng Xiaoping Writes Title for the Newspaper"]

[Text] With the approval of the State Council, China's first national science and technology newspaper--ZHONGGUO KEJI BAO--will be published beginning 1 January 1986 and will be circulated to all parts of the country and overseas areas.

ZHONGGUO KEJI BAO will be jointly run by the State Science and Technology Commission, the National Defense Science, Technology, and Industry Commission, the Chinese Academy of Sciences, the Chinese Association of Science and Technology, and GUANGMING RIBAO under the leadership of the State Council's Leading Group for Scientific and Technological Work.

Deng Xiaoping has written the title for this newspaper.

The guideline for this newspaper is that "economic construction must rely on science and technology, and scientific and technological work must serve economic construction." The newspaper will be oriented to the modernization efforts, to developments in the world, and to the future. It will play a role in enlightening and educating the people with a scientific spirit so as to promote the building of spiritual civilization. It will report our country's strategic decisions and policies for the development of science and technology, new developments and creations in the scientific and technological field, and the reforms of the scientific research system. It will provide technological information related to economic development, education, national defense, and social development. It will report new trends and developments in foreign countries' science and technology so as to promote scientific, technological, and cultural exchanges between China and other countries.

ZHONGGUO KEJI BAO will be a 4-page weekly newspaper published on Wednesday in 1986.

/9738  
CSO: 4008/1028

PUBLICATIONS

SCIENCE, TECHNOLOGY MAGAZINE BEGINS PUBLICATION

OW090909 Beijing XINHUA in English 0730 GMT 9 Oct 85

[Text] Beijing, 9 Oct (XINHUA)--A new magazine entitled FORUM OF SCIENCE AND TECHNOLOGY IN CHINA recently issued its first edition. The magazine contained an article entitled "China's structural reform and open policy", written by Song Jian, minister of the State Science and Technology Commission. The article emphasized that science is the key to modernization. Only by opening China to the outside world can its new scientific discoveries and technology keep pace with development of the world. Closing China to the outside world will only result in perpetual backwardness.

Song Jian said that since China opened its door to the outside world, China has signed over 3,000 cooperation projects with foreign countries, arranged for the exchange of 50,000 experts, and sent over 30,000 students to study abroad. Chinese scientists have joined over 80 international scientific organizations and societies.

The vice president of the Chinese Academy of Sciences, the famous physicist Zhou Guangzhao and the famous economist Yu Guangyuan also wrote articles for the first issue entitled "developing science and technology and vitalizing the national economy--some ideas on the work of the Academia Sinica" and "correct science and technology policy supports the development of China's economic society."

Articles in FORUM OF SCIENCE AND TECHNOLOGY IN CHINA will also introduce recent developments in science and technology throughout the world.

The publication was established by State Science and Technology Commission and the National Research Center for Science and Technology for Development. Topics will include strategy and policy, decision and management, system reform, science and technology legislation, intellectual resource development.

FORUM OF SCIENCE AND TECHNOLOGY IN CHINA is published bimonthly and will be on sale both at home and abroad.

/9738

CSO: 4010/1025

PUBLICATIONS

BRIEFS

SCIENTIFIC NEWS STARTS PUBLICATION--Beijing, 27 Nov (ZHONGGUO XINWEN SHE)--KEJI XIN WEN [SCIENTIFIC NEWS], a newspaper catered to the needs of scientific and technological personnel and enthusiasts, is to start publication today in Beijing. Sponsored by the Shandong Scientific and Technological Association and other organs, each issue of the weekly newspaper will be published in quarto with four pages. At the forum held today at the Beijing Hotel to mark the first issue of the newspaper, Xu Deheng, vice chairman of the NPC Standing Committee, expressed hope that the newspaper would spread Chinese and foreign scientific and technological news, serve the needs of society, and contribute to China's economic revitalization. Yan Jici, vice chairman of the NPC Standing Committee; Mao Yisheng, vice chairman of the CPPCC; and noted figures of scientific and technological circles Jin Baoshan, Huang Jiqing, Wang Jinchang, and Jia Lanpo attended the forum on invitation. [Text] [Beijing ZHONGGUO XINWEN SHE in Chinese 1410 GMT 27 Nov 85 HK] /9738

CSO: 4008/1028

## THE EFFECTS OF FLUORIDE-BEARING GAS ON AIR QUALITY IN BISC AREA AND ITS COMPREHENSIVE TREATMENT

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese  
Vol 5 No 5, 21 Oct 85 pp 8-15, 32, 18

[English abstract of article by Cai Cunfu [5591 1317 4395] and Yu Jingwen [0060 2417 2429], Central Research Institute of Building and Construction, Ministry of Metallurgical Industry]

[Text] The results of field testing, an environmental wind tunnel and a diffusion model which studied the effects of fluoride-bearing gas in the Baotou Iron and Steel Company (BISC) area are described. The practicality of the site and general layout of the factory is reviewed according to the pollution characteristics and fluoride-bearing gas migration diffusion law. The fluoride ground concentrations at various working conditions of production are predicted by the ATCM model. According to the favorable and/or unfavorable diffusion conditions of the gas, ways to comprehensively treat the fluoride-bearing gas are suggested.

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## ANALYSIS OF ORGANIC POLLUTANTS IN THE TOJIANG RIVER

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese  
Vol 5 No 5, 21 Oct 85 pp 19-26

[English abstract of article by Yang Youming [2799 0645 2494], Liu Yongxing [2692 3057 5887] and Li Ruiqin [2621 3843 3830], et al., Chinese Research Academy of Environmental Sciences]

[Text] Samples were collected during two dry season periods, 24 November to 2 December 1983 and 3 to 13 April 1984. The sampling site was at a waterwork inlet at the Neijing section of the Tojiang River. Samples were analyzed by capillary GC-MS and capillary GC-FID for organic pollutants. The water samples were enriched by Amberlite XAD-2 macroreticular resin.

The solvent used for eluting organic compounds from the XAD-2 column was a mixture of acetone and cyclohexane (2:3v/v). The eluate was dried by passing through an anhydrous Na SO column, and then concentrated in a K-D evaporator at 50-55°C to a final volume of 0.4-0.5 ml.

In water samples from the Tojiang River, 144 organic compounds were found by use of the SE-54 column and 38 additional compounds were found with Dexsil-300. From the results of CCGC/MS/DS analysis, 173 organic compounds have been identified. Because of the limited number of standard compounds available, only 10 compounds found in the Tojiang River were quantitatively determined. Their concentrations are in the range of several ppt to several hundred ppt. The recoveries of some pollutants have been determined.

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STUDIES OF THE PROPERTIES OF DEGRADATION OF INORGANIC CYANIDE IN THE GAS-PRODUCING WASTEWATER BY ARTIFICIAL SCREENING CYANIDE-DECOMPOSING BACTERIA STRAINS

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese Vol 5 No 5, 21 Oct 85 pp 27-32

[English abstract of article by Lu Yin [0712 5419], Li Qiugui [2621 4428 2710], Yao Fengyun [1202 7685 0061], et al., Anhui Research Institute of Environmental Protection, Hefei]

[Text] Five highly efficient decyanide baceteria strains have been isolated from sludge of an effluent outlet of cyanide-containing gas-producing wastewater and the biofilm of a biological trickling filter tower of a synthetic ammonia factory. A strain of these cyanide-decomposing bacteria was identified as Arthrobacter sp. no. 8. Their average biodegradation efficiency for inorganic cyanides was 93.1 percent when the initial concentration of the cyanide was 25.02-27.93 mg/l, while the highest removal efficiency was 96.8 percent. The results of tests indicate that Arthrobacter sp. no. 8 can use inorganic cyanides as the sole source of nitrogen and carbon for its growth.

The similar high decomposition efficiency with total removal rate of 91.53 percent was obtained in the direct treatment of gas-producing wastewater containing inorganic cyanide by the mixed bacterial culture mainly of the above five artificial screening strains. It is possible to offer a highly efficient inoculum of biological filming for treating gas-producing wastewater due to the stability of biodegradation activity for cyanides and a small supplement of carbon and phosphorus sources as well as a highly efficient poison removal.

In this paper, studies of the condition of  $CN^-$  degradation in the process of growth of the decyanide strains are reported.

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## THE POLLUTION DISTRIBUTION OF ELECTROMAGNETIC RADIATION IN TAIYUAN AREA

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese  
Vol 5 No 5, 21 Oct 85 pp 73-76

[English abstract of article by Liu Wenkui [0491 2429 7608] and Liu Shuqian [0491 2579 0051], Shanxi Medical College; Department of Broadcast and Television of Shanxi Province]

[Text] The applications of high frequency and microwave technology to industrial and agricultural production and the spread of broadcasting, television, communications, radar, etc., have produced strong electromagnetic radiation which pollutes the human environment. Through the investigation of 51 experimental sites in the Taiyuan area, we have found that the electric field of intensity of one-fourth of them exceeded the suggested standard, and now about 90,000 people live in such environments which may affect their health adversely. It is thus clear that electromagnetic radiation has become a factor in environmental pollution and tends to be more and more serious. Therefore, we should strengthen the management of and formulate hygienic standards for electromagnetic radiation in order to protect the environment of inhabitants.

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POLLUTION OF DALIAN BAY AND THE IMMUNE FUNCTION OF MALE PUPILS

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese  
Vol 5 No 5, 21 Oct 85 pp 77-78

[English abstract of article by Zhang Libo [1728 0448 0130], et al., Liaoning Provincial Anti-epidemic Station; Jin County Anti-epidemic Station; and Zhang Nianqing [1728 1628 1987], et al., Changhai County Anti-epidemic Station]

[Text] Using the non-specific immunological indexes suitable for practical uses, such as salivary lysozyme, automicrobes of deep layers of the skin, skin tests of PHA and phosphatase alkaline of WBC, we have investigated the immune functions of male pupils living in the area of Dalian Bay polluted by sewage containing arsenic compounds, etc.

The results show that there is no obvious difference between those in the polluted area and the control area, except for the number of automicrobes of deep layers of the skin which is distinctly higher in those in the polluted areas than in the control area.

It is suggested that because the pollution in the Dalian Bay area has been reduced in recent years, its effects on the health of the body has been sensitively reflected on the situation of the pupils' immune functions.

9717

CSO: 4009/1020

## FOURIER-TRANSFORM HOLOGRAPHIC DIFFRACTION INTERFEROMETRY: PRINCIPLE

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 12  
No 11, 20 Nov 85 pp 641-647

[English abstract of article by Liu Liren [0491 4539 0086] of the Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] By using Fourier-transform holograms as coded masks in coded grating  
Fourier-transform diffraction interferometry with extended white light  
illumination, a new kind of Fourier-spectrum diffraction interferometry is  
thus realized. Any expected form of interference can be easily yielded  
according to the pattern recorded in the hologram used. The performance is  
analyzed in detail by virtue of the backward impulse response.

LONGITUDINAL-MODE BEHAVIOR OF STRIPE-GEOMETRY SEMICONDUCTOR LASERS WITH VERY LONG CAVITY

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 12 No 11, 20 Nov 85 pp 664-667

[English abstract of article by Shen Feng [3088 1496] and Xie Jingshan [6043 6855 1472], of Wuhan Research Institute of Post and Telecommunication Science; and Guo Changzhi [6753 7022 1807], Department of Physics, Beijing University]

[Text] The longitudinal-mode behaviors of a proton-bombarded stripe-geometry GaAs-GaAlAs laser with a very long cavity have been investigated experimentally and theoretically. It has been found that the devices with long cavities can maintain stable single longitudinal mode operation over a wide current range above threshold.

DUAL-WAVELENGTH OSCILLATION OF SEMICONDUCTOR LASERS IN EXTERNAL CAVITIES

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 12 No 11,  
20 Nov 85 pp 668-671

[English abstract of article by Chen Jianguo [7115 1696 0948] of the Physics  
Department, Sichuan University]

[Text] Dual-wavelength oscillation of a semiconductor laser in an external cavity has been observed. This phenomenon has been attributed to the interference of the two feedback beams, one of which passes through the active layer and the other through the cladding layer(s). The modulation phenomenon on the tuning curve of the tunable semiconductor laser in the external cavity has therefore been explained.

AN ELECTRO-OPTICAL STABILIZER FOR PULSED LASER OUTPUT

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 12 No 11,  
20 Nov 85 pp 675-677

[English abstract of article by Hu Qiquan [5170 0120 6898] and Shu Haizheng  
[5289 3189 3791], et al., of Shanghai Institute of Optics and Fine Mechanics,  
Chinese Academy of Sciences]

[Text] An E-O stabilizer for pulsed laser output applicable to many types of  
pulsed lasers has been developed. We present here both the operational  
principle and the experimental results. Its insertion loss is 20 percent.  
Using this device the pulsed laser output fluctuation can be decreased from  
more than 10 percent to less than 2 percent.

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CSO: 4009/24

RESONATORS WITH SIDE REFLECTORS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5 No 10, Oct 85  
pp 870-875

[English abstract of article by Fang Honglie [2455 3163 3525] of Shanghai  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A slab laser can reduce the effect of thermal-optical distortions due to its intrinsic phase-conjugate properties. Therefore, it is a good laser structure. A rod laser with polished side surface has similar properties because it has a special kind of resonator with side reflectors. Modes of such resonators are analyzed in this paper. The analytic results show that diffraction losses become smaller and mode distributions stronger in the central part of the end reflectors.

RELAXATION OSCILLATION OF AMPLIFIED SPONTANEOUS RADIATION PULSE EMITTED FROM  
A SINGLE-MIRROR Cu/CuBr LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5 No 10, Oct 85  
pp 876-880

[English abstract of article by Wang Yongjiang [3076 3057 3068] and Xia Tiejun  
[1115 6993 0689] of the Department of Physics, Zhejiang University, Hangzhou]

[Text] The relaxation oscillation of the amplified spontaneous radiation  
pulses emitted from a single-mirror Cu/CuBr laser has been observed for the  
first time and the experimental characteristics of the relaxation oscillation  
are obtained. In addition, the spatial and temporal distributions of the  
light pulse intensity of the amplified spontaneous radiation were measured  
and found to be comparatively uniform. The spatial coherence of the amplified  
spontaneous radiation was found to be better than that of the laser with the  
same lasant.

# ANALYSIS OF BANDWIDTH CHARACTERISTICS IN SINGLE-MODE FIBER COUPLERS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5 No 10, Oct 85  
pp 897-903

[English abstract of article by Yao Huihai [1202 1979 3189] and Chen Yiqiang [7115 5065 1730] of Shanghai University of Science and Technology, Shanghai Optical Fiber Technique and Modern Communication Research Institute]

[Text] Based on solving the coupled mode equation with coupling coefficients as functions of longitudinal distance, single-mode fiber couplers with variable spacing are introduced and their coupling characteristics discussed. We reach the conclusion that grade separation couplers have optimum bandwidths after various insertion losses are calculated. The method for realizing broad spectral bandwidth single-mode fiber couplers and the related design procedure are also proposed.



FRESNEL ZONE PLATE INTERFEROMETER AND ITS APPLICATION IN LASER WAVEFRONT MEASUREMENT

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5 No 10, Oct 85 pp 910-915

[English abstract of article by Gu Tianqu [7357 1131 5900], Wu Shudong [0124 2885 2639] and Yu Wenyan [0151 2429 3508] of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A new kind of interferometer--the Fresnel zone plate interferometer--is described. It combines the advantages of both radial and lateral shearing interferometers, and thus simplifies the analysis of interferograms. This interferometer is a commonpath system. It can be used in the wavefront diagnosis of broad-band lasers and short pulse lasers. Properties of the interferometer are discussed and experimental results in laser wavefront diagnostics summarized.

TWO-DIMENSIONAL HARTMANN QUANTITATIVE TEST OF AN ASPHERICAL PRIMARY MIRROR ( $\phi 2.16$  m)

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5 No 10, Oct 85 pp 916-925

[English abstract of article by Gao Bilie [7559 1801 3525], Li Depei [2621 1795 1014] and Pan Janhua [3382 0689 7520] of Nanjing Astronomical Instruments Factory, Chinese Academy of Sciences]

[Text] This paper deals with the two-dimensional Hartmann quantitative test of the largest hyperboloidal primary mirror made in China. It is the first of its kind carried out in this country. It provides geometrical energy concentration, spot diagram at best focus, contour map for the mirror and aberration coefficients of Zernike polynomial fitting wavefront. In addition, parameters of the real shape, i.e., real radius of its curvature ( $R$ ) and function of eccentricity of a conic surface ( $e^2$ ) are given.

A 2-J PULSE AVALANCHE XeCl EXCIMER LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5 No 10, Oct 85  
pp 955-957

[English abstract of article by Lou Qihong [2869 4388 3163], Ding Aizhen  
[0002 1947 5271], et al., of Shanghai Institute of Optics and Fine Mechanics,  
Chinese Academy of Sciences]

[Text] Based on optimization of parameters of an avalanche XeCl laser, we  
have obtained an output pulse energy of 2J/1-atm by using low-inductance  
capacitors and the laser discharge power supply.

9717

CSO: 4009/25

Organic Chemistry

APPLICABILITY OF HEAD-SPACE GAS CHROMATOGRAPHY IN THE ANALYSIS OF WATERBORNE ORGANIC POLLUTANTS

Shanghai YOUJI HUAXUE [ORGANIC CHEMISTRY] in Chinese No 4, Aug 85 pp 342-345

[Article by Shi Mei'er [2457 2734 0348] and Hu Zhenyuan [5170 2182 0337]  
the Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences]

[Abstract] The authors applied the static and dynamic head-space method combined with gas chromatography or mass chromatography for isolation and determination of chemical compounds (such as alkyl halides) in tapwater and water from Huangpu River at Shanghai Municipality. However, the prediction of which organic pollutants are determinable by the above-mentioned method remains a problem defying a complete solution. The paper discusses this topic and selects analytical conditions related to the dynamic method. For 30 minutes purging was carried out to determine the volatile alkyl halides in water. As proved experimentally, this technique can satisfy the requirements of trace analysis with results that are basically consistent with the static head-space method, referring to reference No 4 in the Bibliography. Three tables list data on the vapor pressure, solubility, partition coefficient, and injection amount of organic compounds; detection limit of some organic halides in water; and the effect of purging time on gas-extraction efficiency. The authors are grateful to Professor Yu Wenci [0205 2429 7625/2974] for his assistance.

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CSO: 4009/1018

TAIWAN

BRIEFS

NEW FACSIMILE SYSTEM--Taipei, 9 Dec (CNA)--Microtex Corp., a computer company in the Hsinchu science-based industrial park in northern Taiwan, announced Monday that it had successfully developed a personal computer facsimile system, which, it said, will enable personal computers around the world to rapidly exchange information or transmit documents and photos through telephone lines. A spokesman for Microtex said that the system is the first of its kind in the world. Similar products developed by other large computer companies will come out at least one month later, he said. Microtex has named its new product "Ms-Fax." The system, in addition to combining the functions of personal computers and facsimile, can also perform such tasks as calculation, storing information, drafting, editing, enlarging or reducing the transmitted documents and photos. [Excerpt] [Taipei CNA in English 1445 GMT 9 Dec 85 OW] /9738

32-BIT DEVELOPMENT SYSTEM--Taipei, 7 Dec (CNA)--Microtek International Inc. became the world's first company to design and market a 32-bit microcomputer development system when it introduced its MICE-32/68020 system to the local press Thursday. Microtek, located in the Hsinchu science-based industrial park, began working on the project a year ago, right after Motorola introduced its renowned 68020 chip for use in 32-bit computers, according to Microtek's vice president, Carter Tseng. Several American and Japanese firms engaged in similar projects are expected to announce their products sometime after the first quarter of next year, Tseng added. Because the MICE system emulates the functions of a 32-bit computer, it is designed to serve as a tool for development 32-bit systems. For this reason, the MICE system is expected to play a key role in aiding local firms to develop 32-bit computers. Microtek has already marketed a number of development systems for both 8-bit and 16-bit microcomputers. [Text] [Taipei CNA in English 0313 GMT 7 Dec 85 OW] /9738

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